



Title: SYSTEMS AND METHODS FOR PHASE
MEASUREMENTS
Inventor Name: C.M. Fang-Yen, et al.
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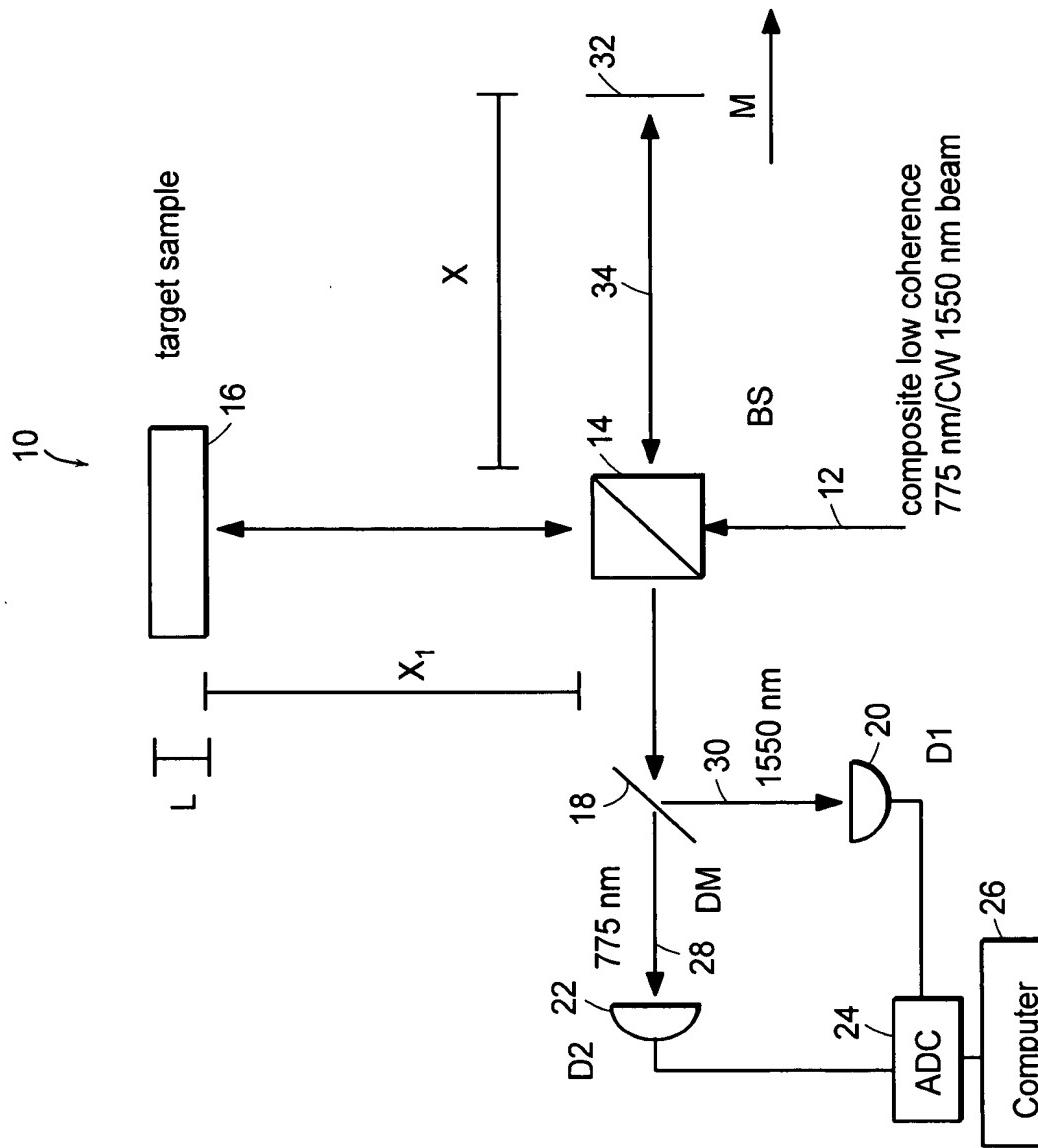


FIG. 1

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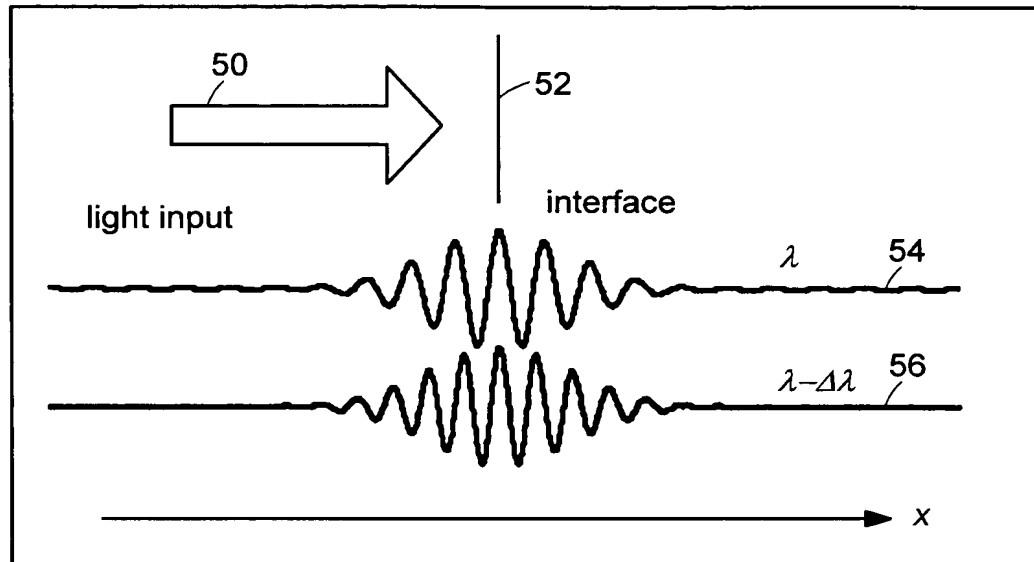


FIG. 2

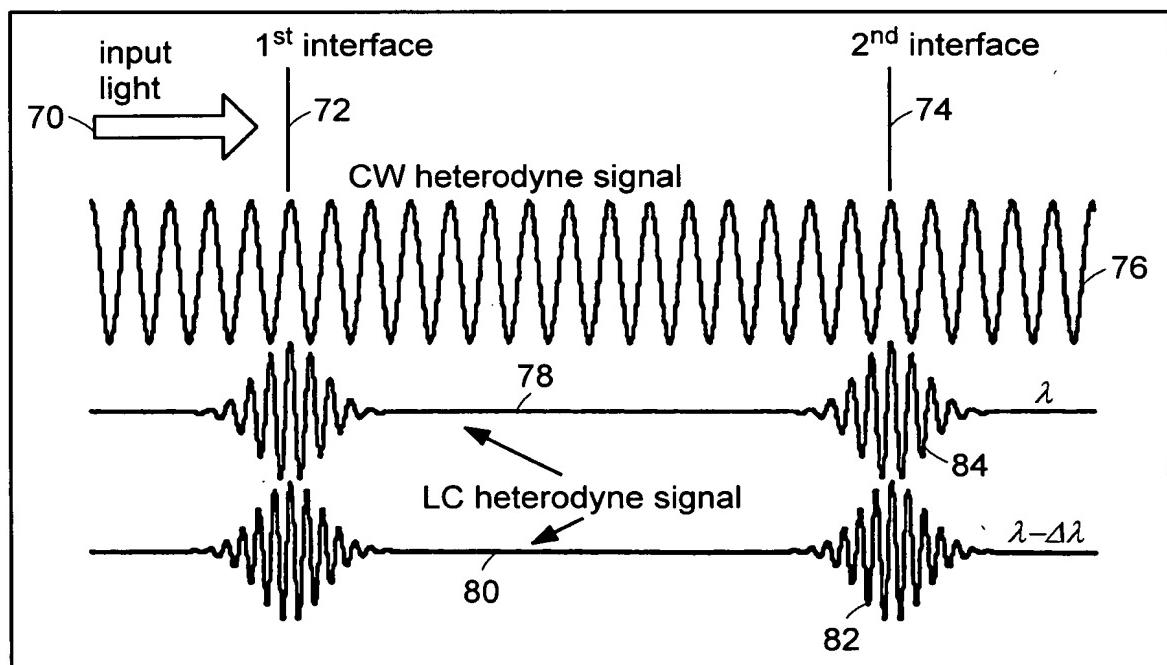


FIG. 3

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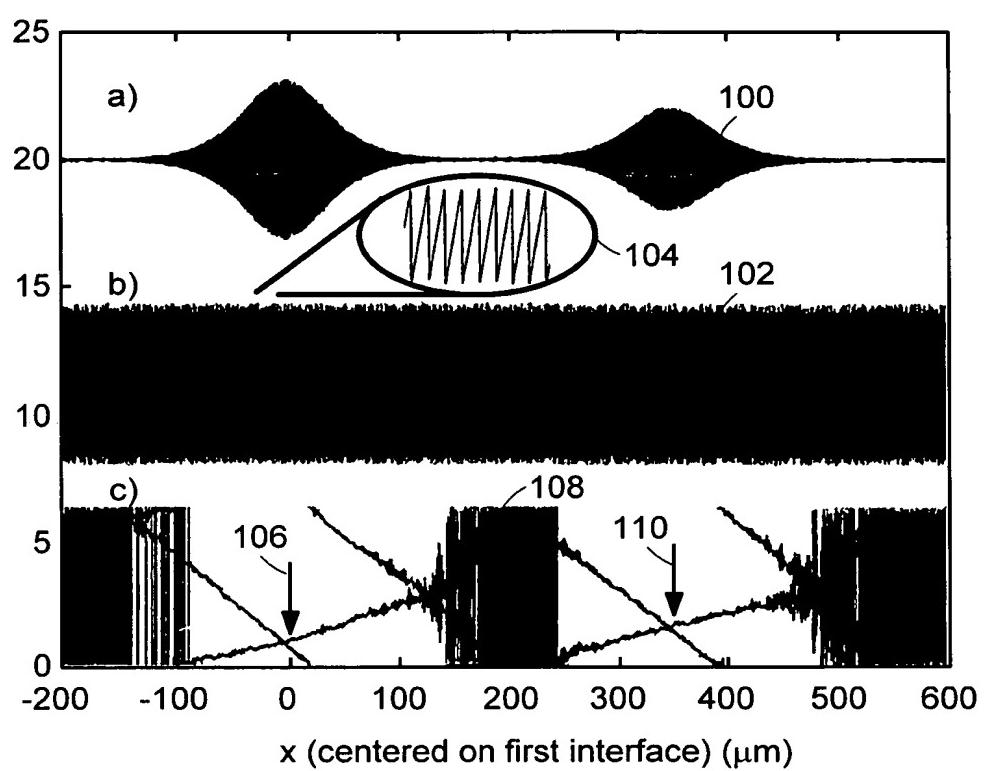


FIG. 4

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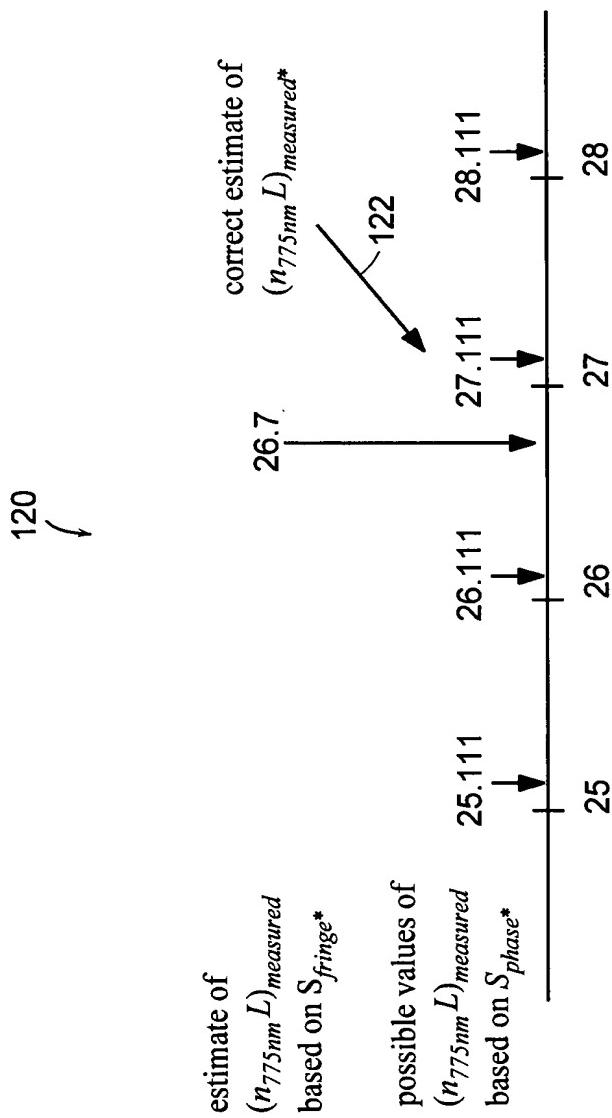


FIG. 5

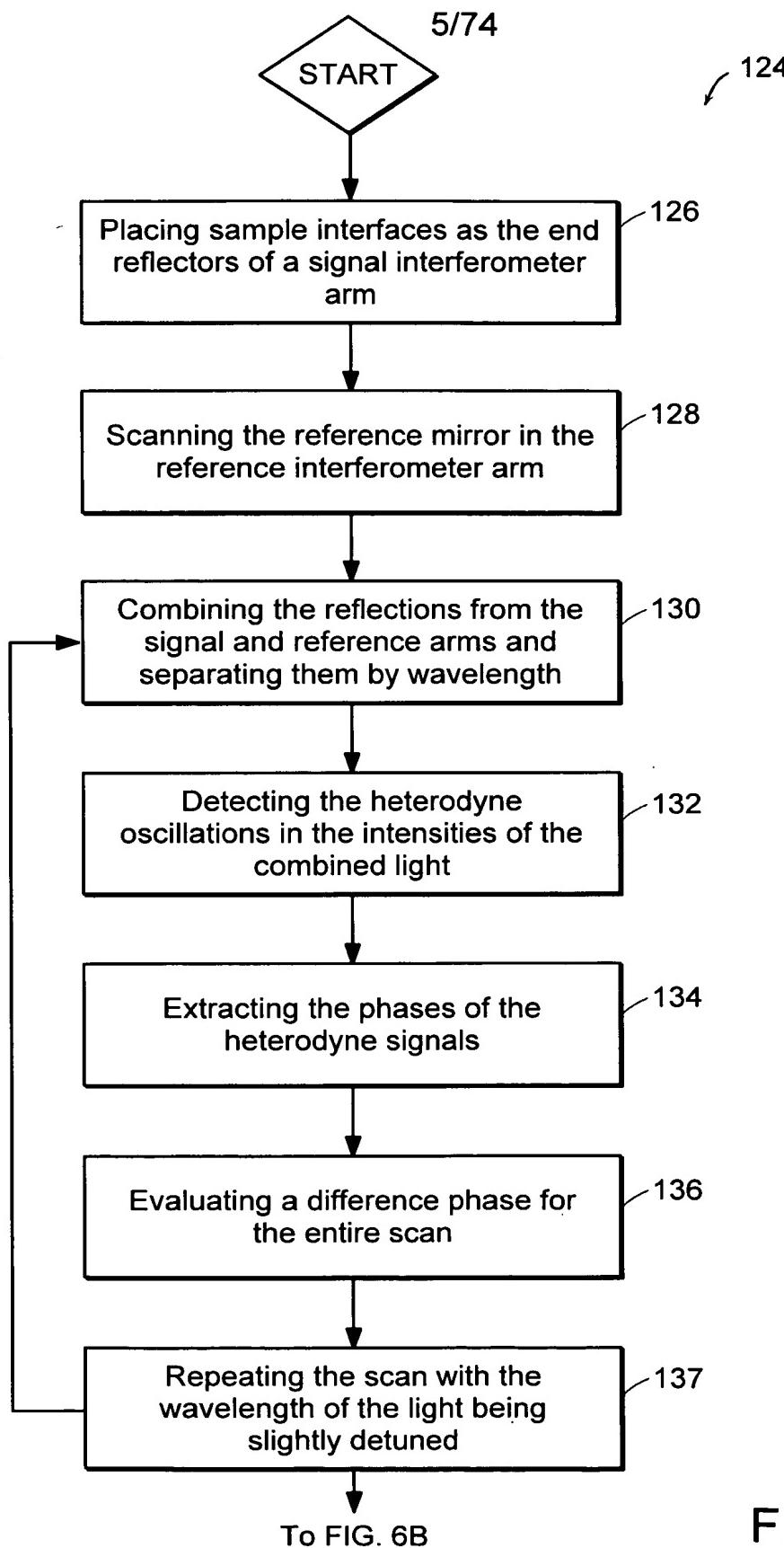


FIG. 6A

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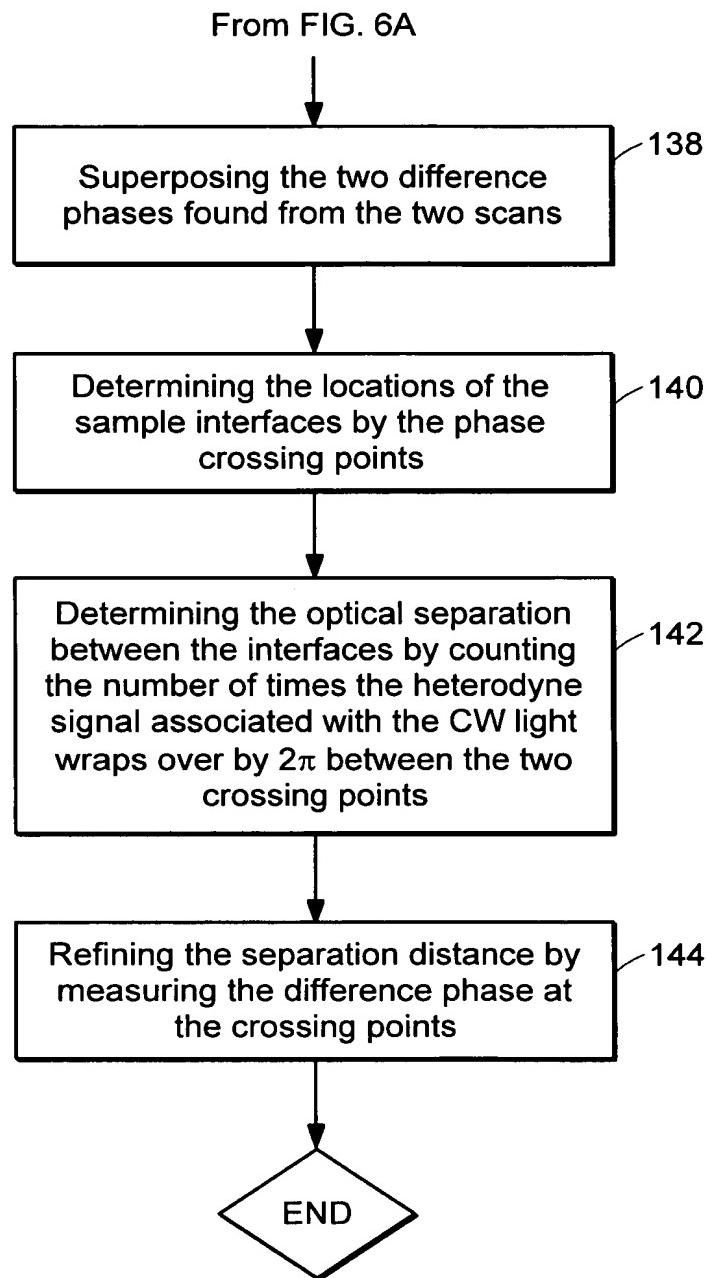


FIG. 6B

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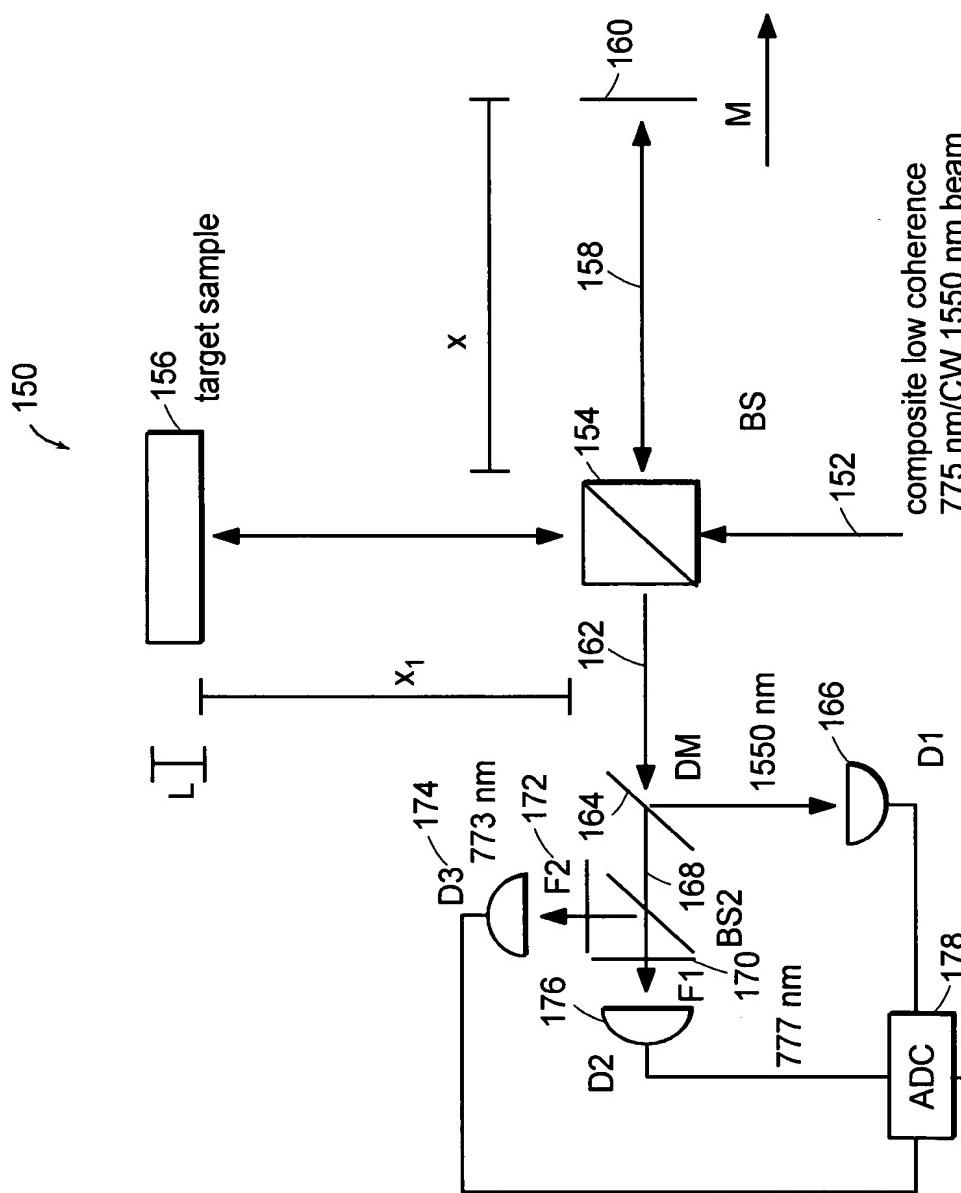
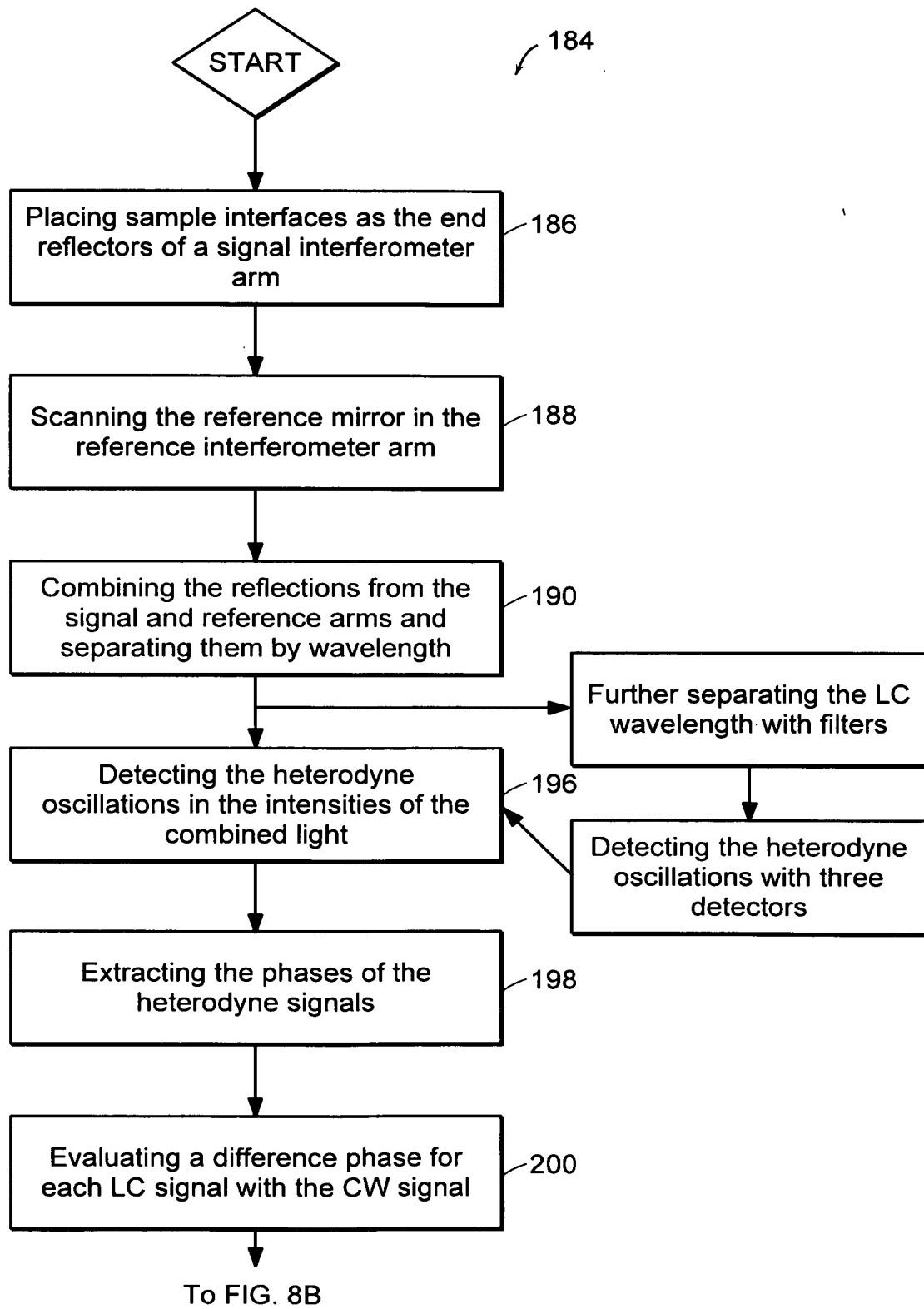


FIG. 7

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To FIG. 8B

FIG. 8A

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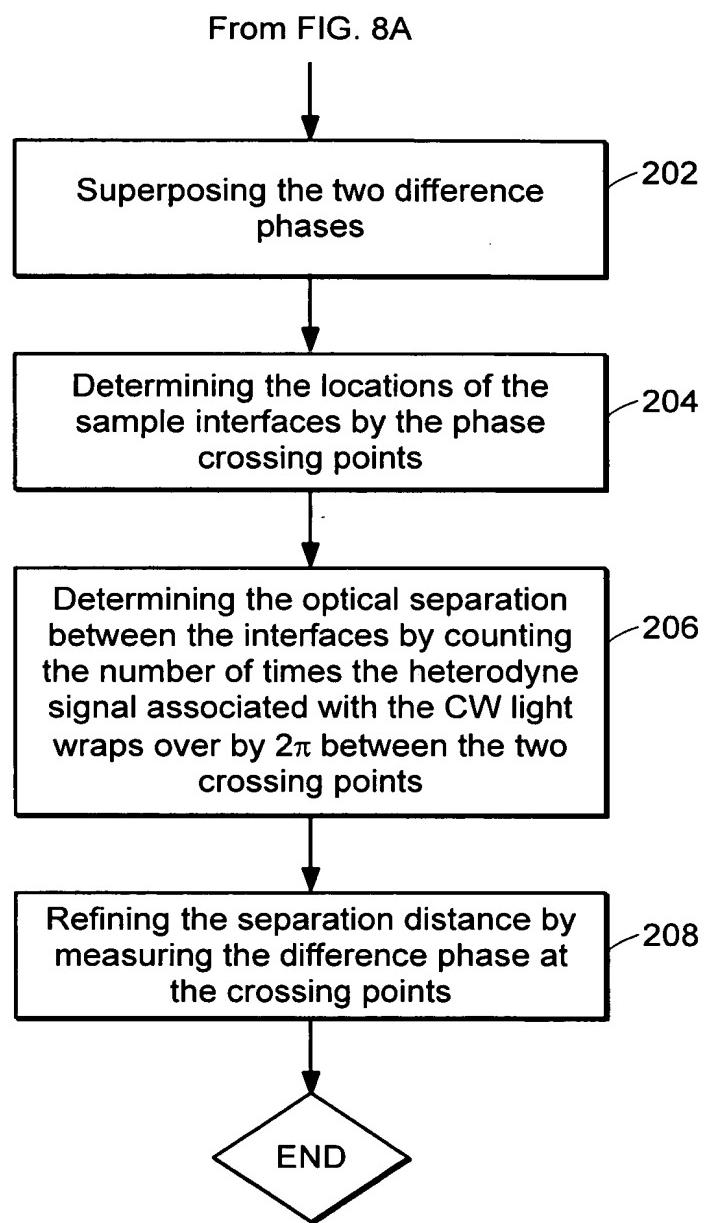


FIG. 8B

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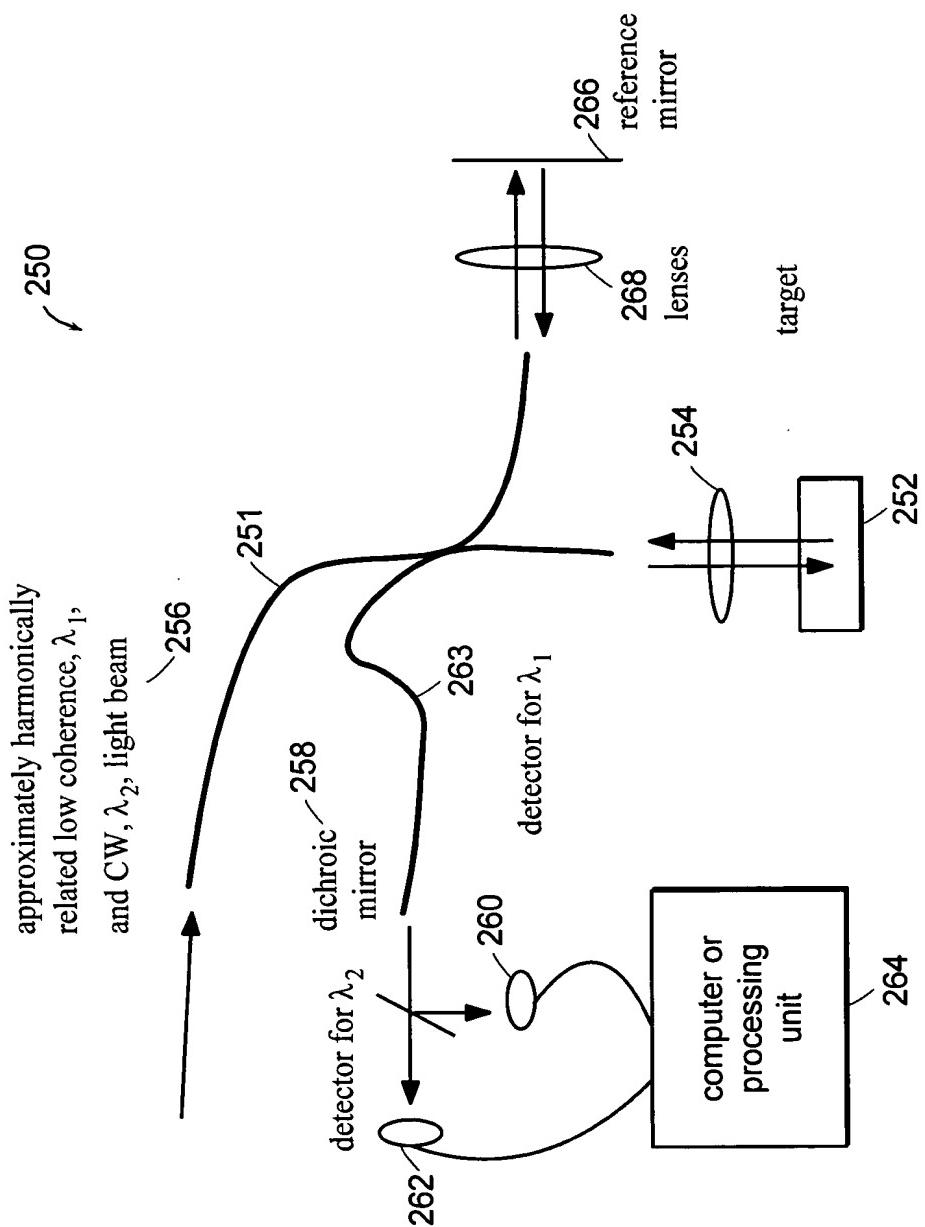


FIG. 9

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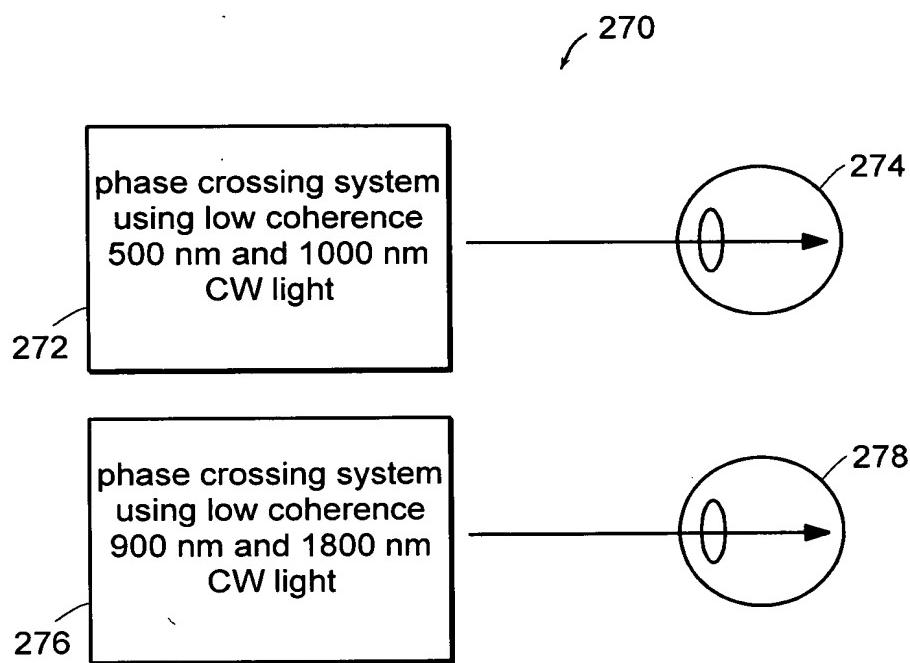


FIG. 10

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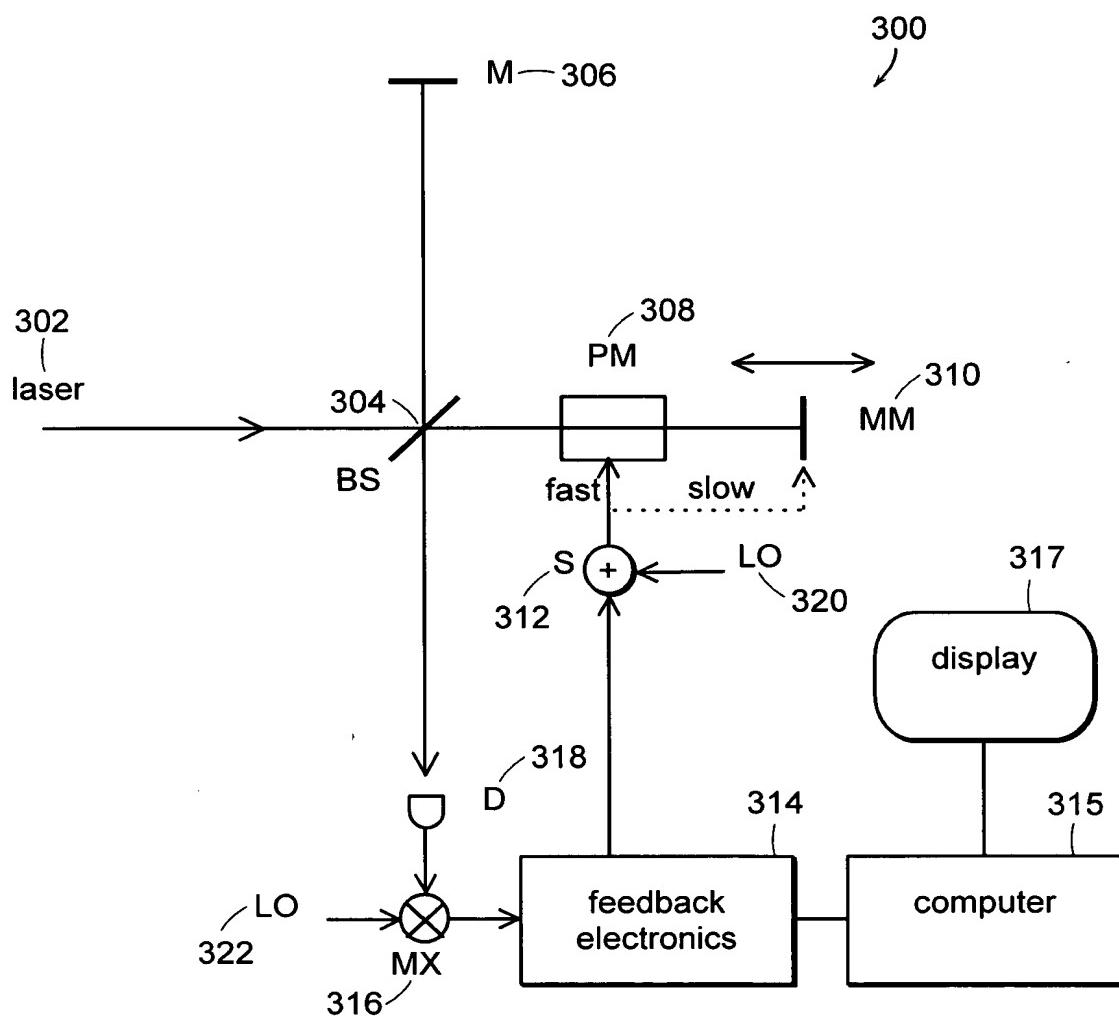


FIG. 11

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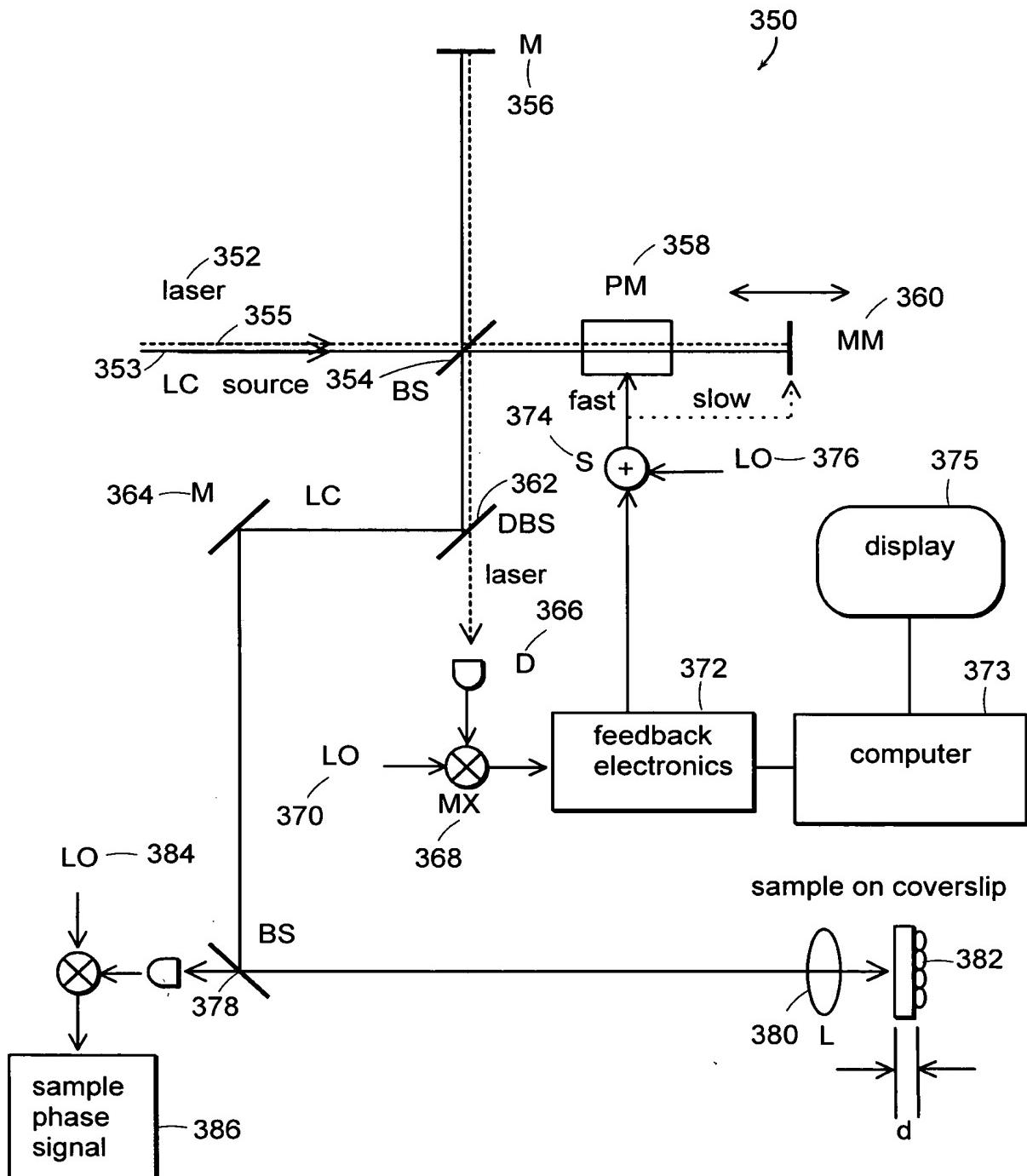


FIG. 12

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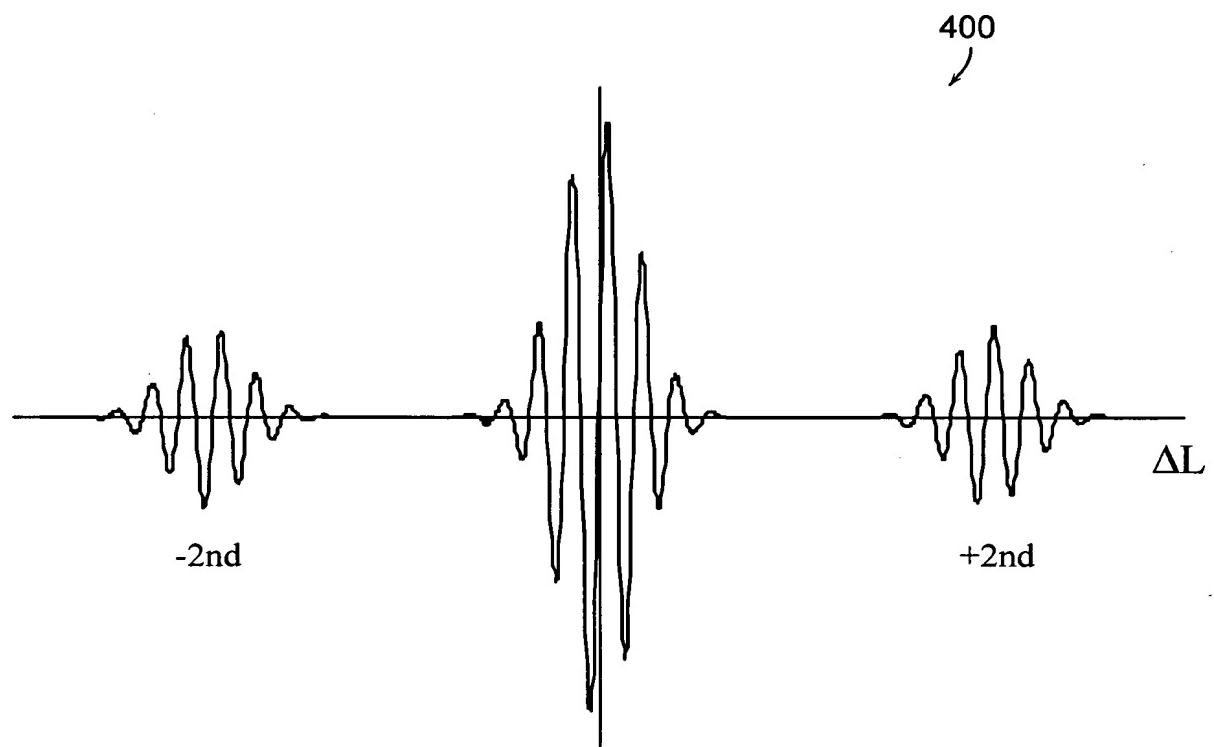


FIG. 13

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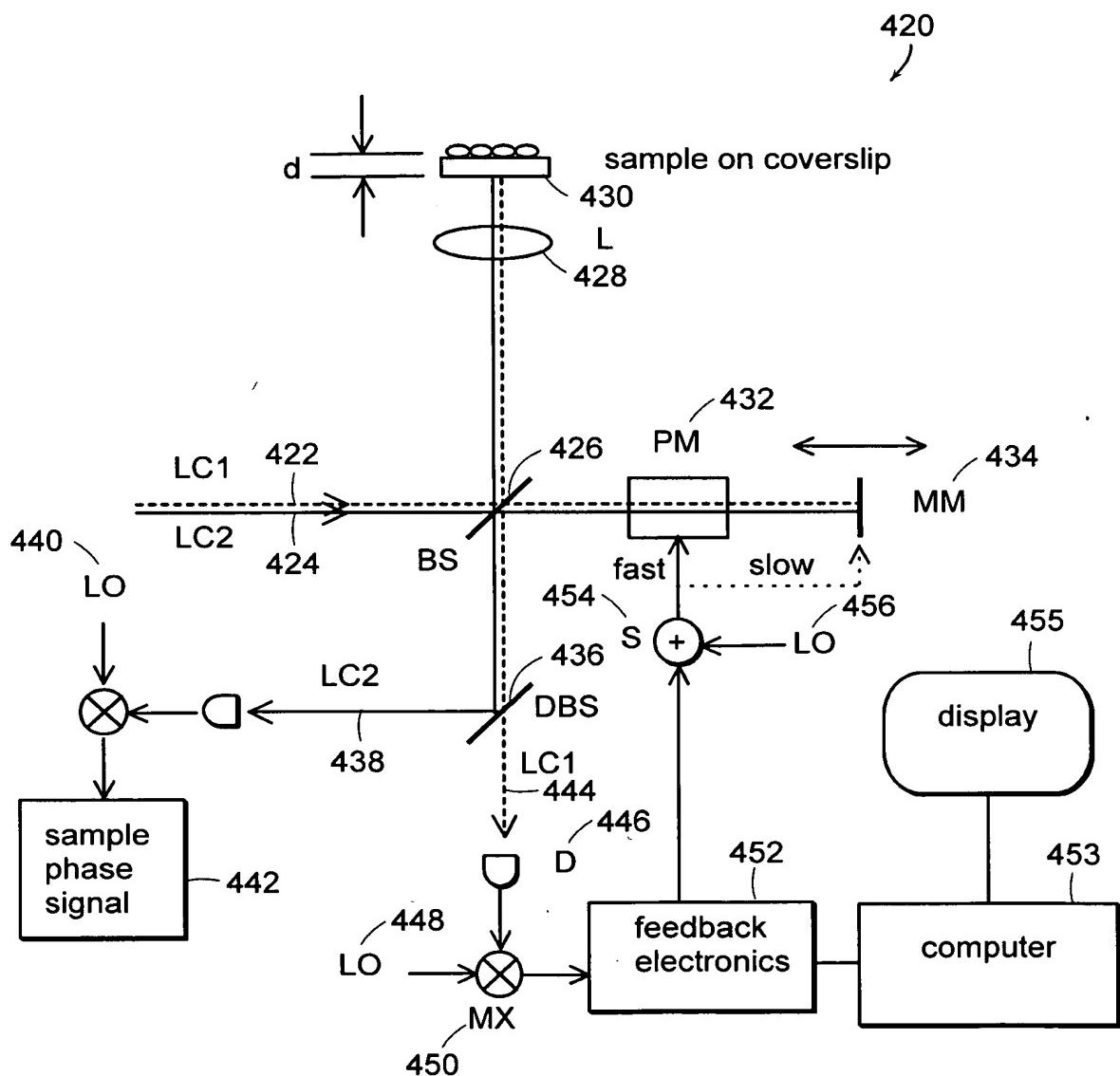


FIG. 14A

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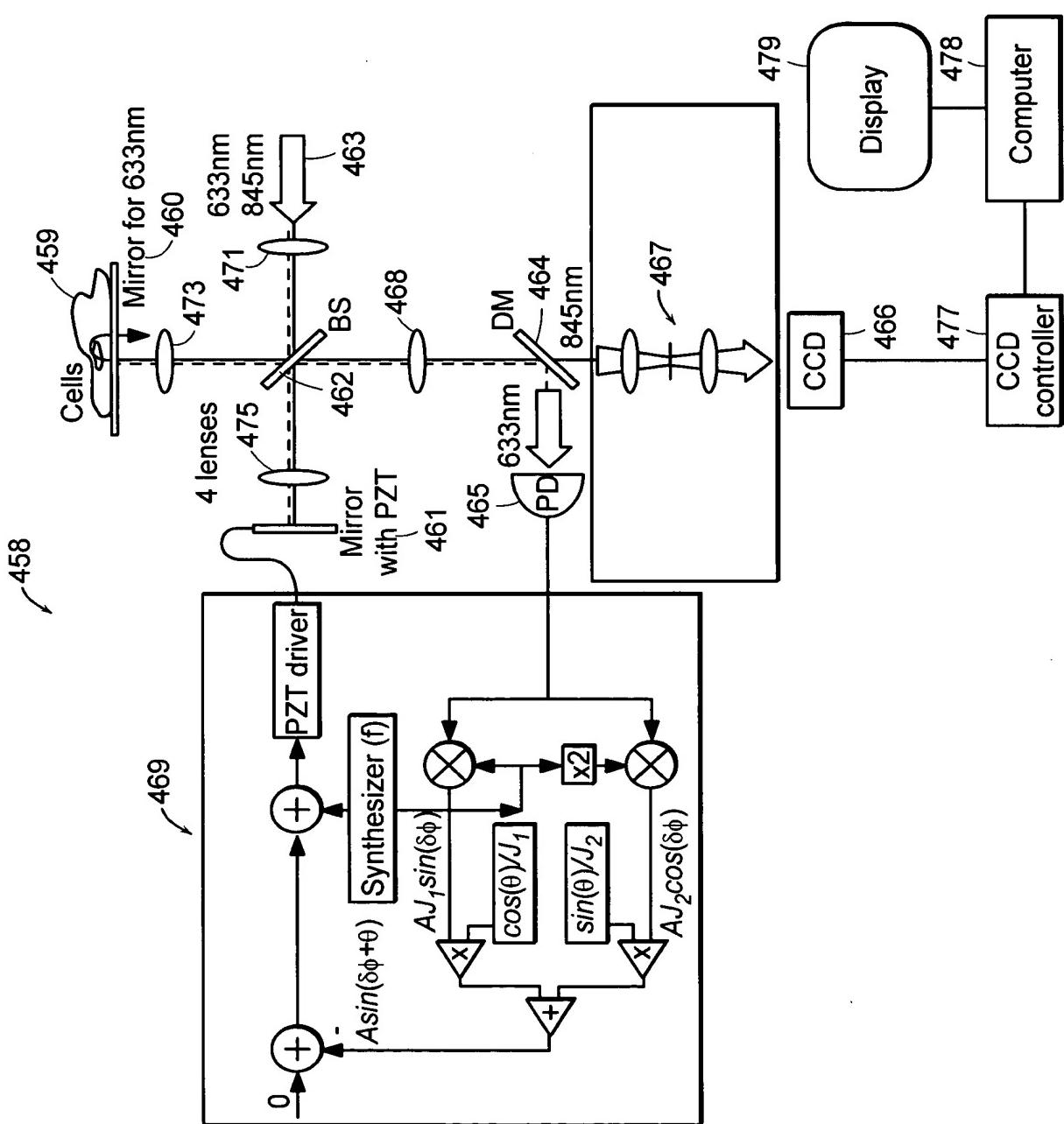
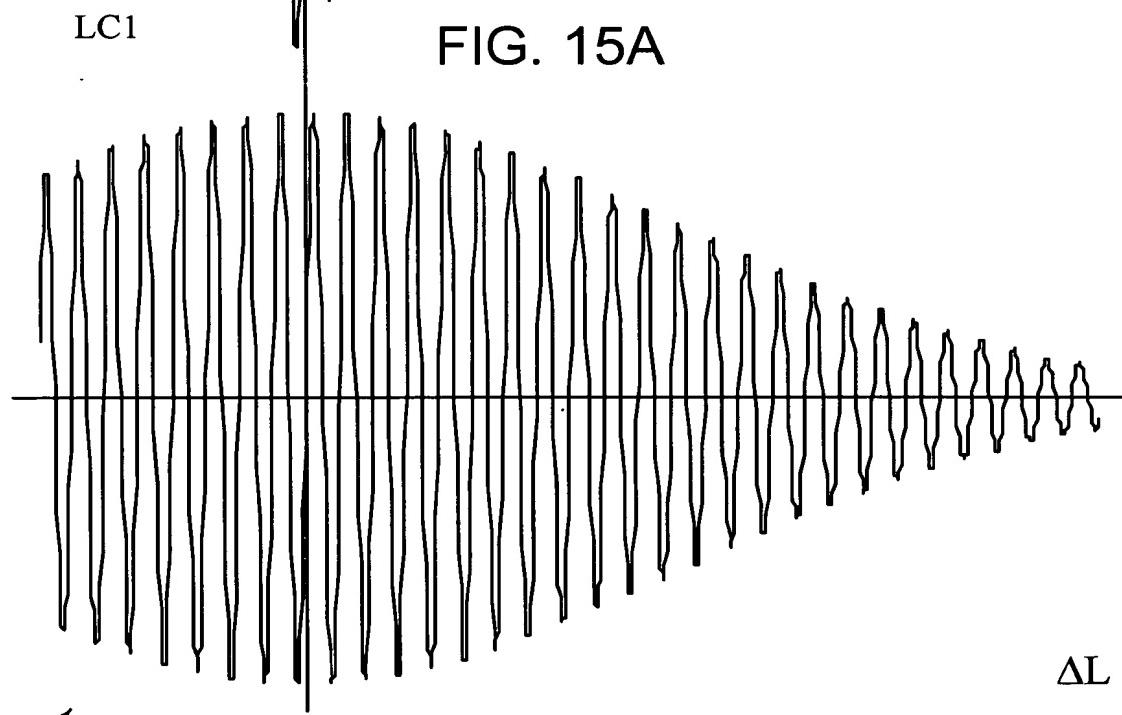
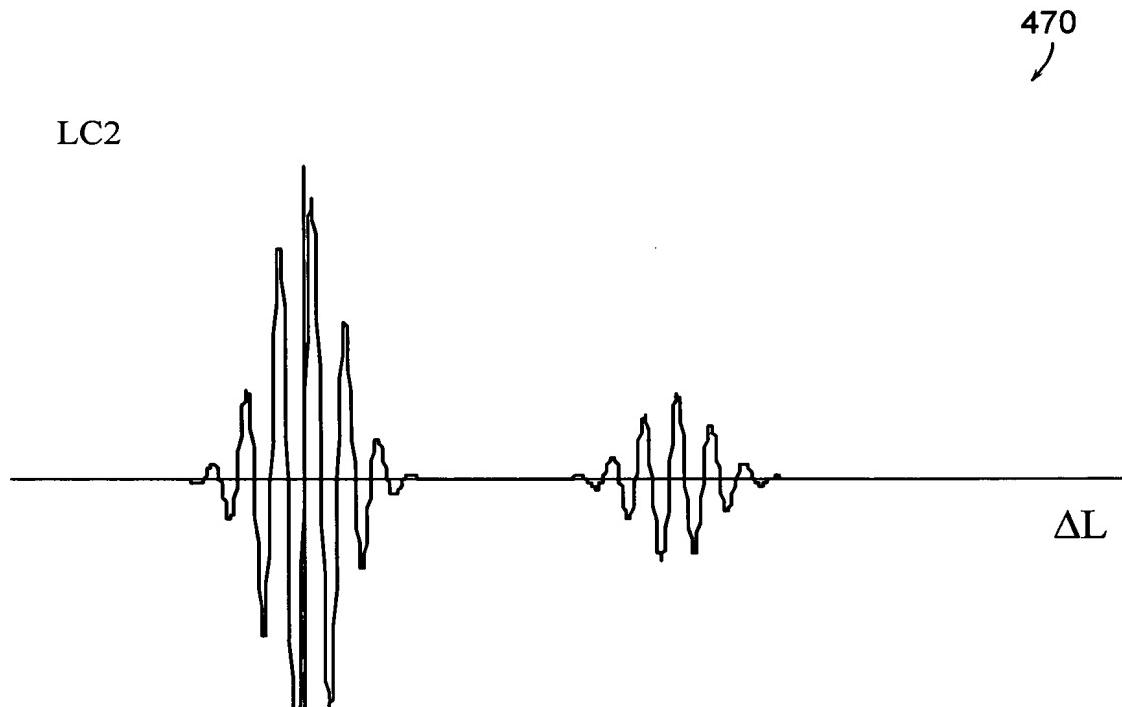


FIG. 14B

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FIG. 15B

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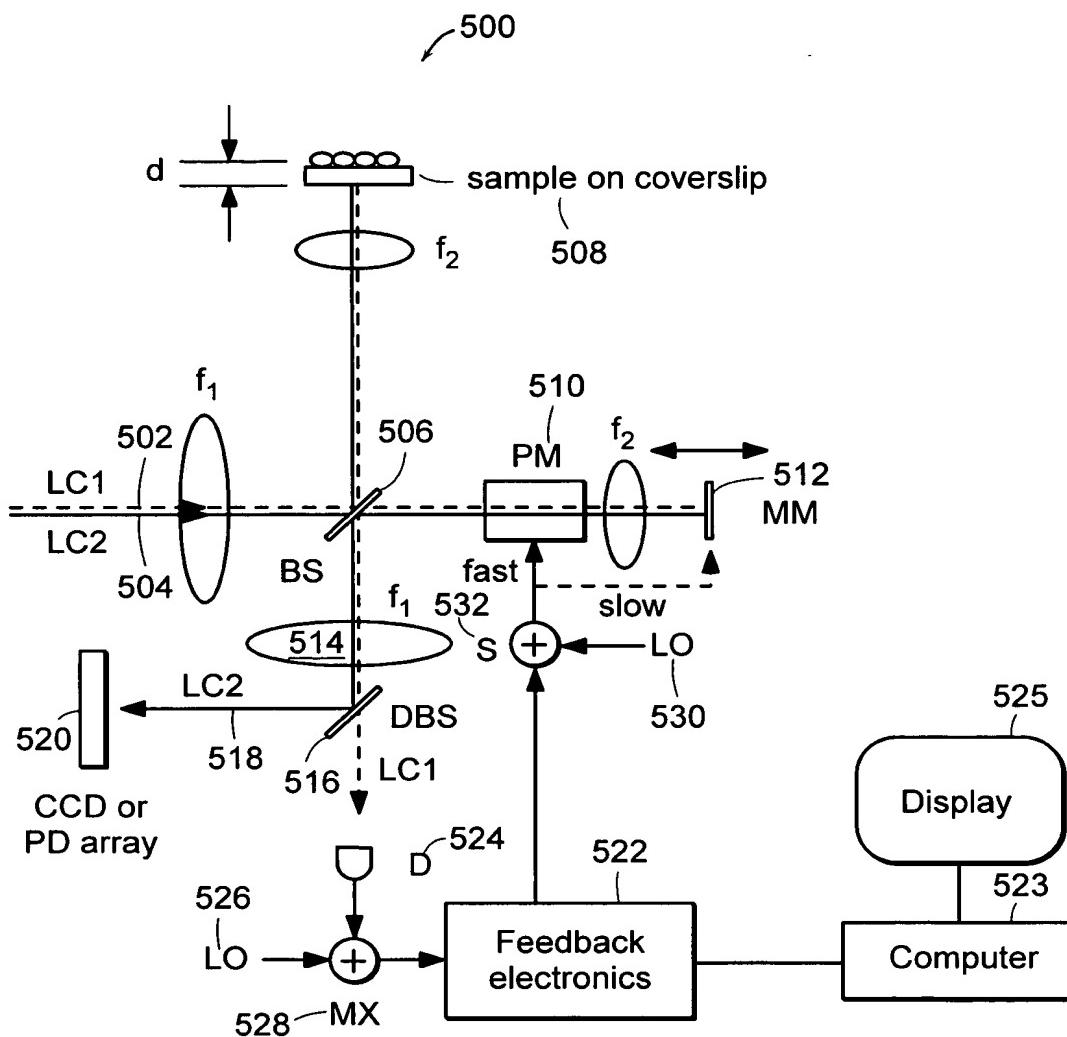


FIG. 16

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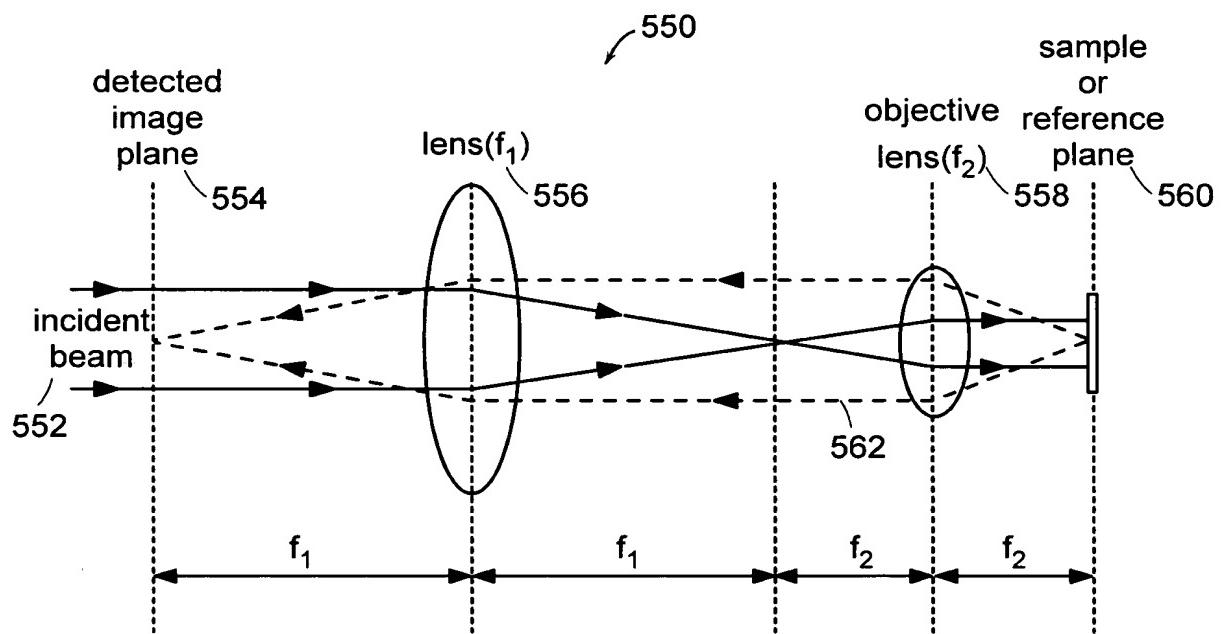


FIG. 17

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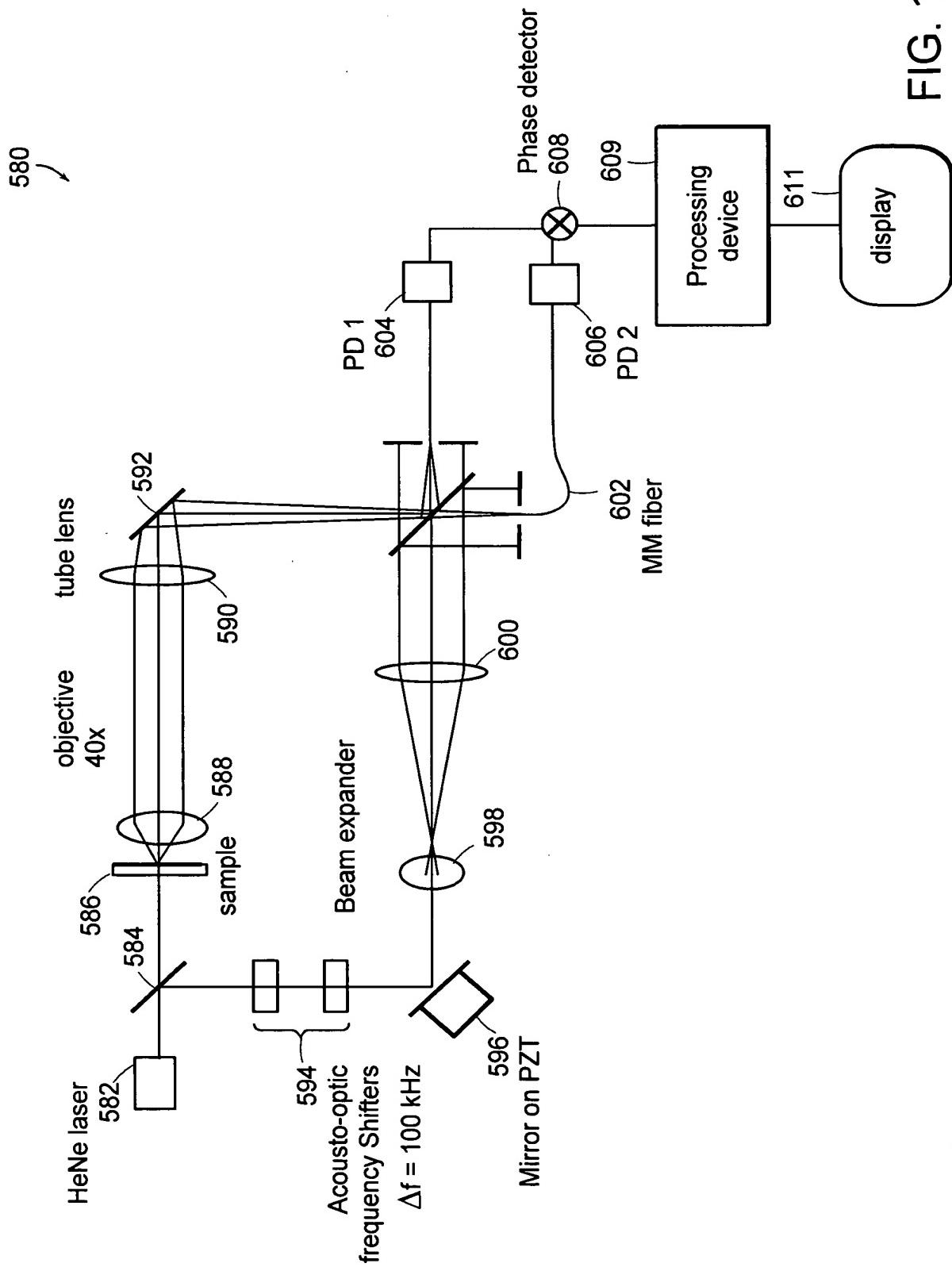


FIG. 18A

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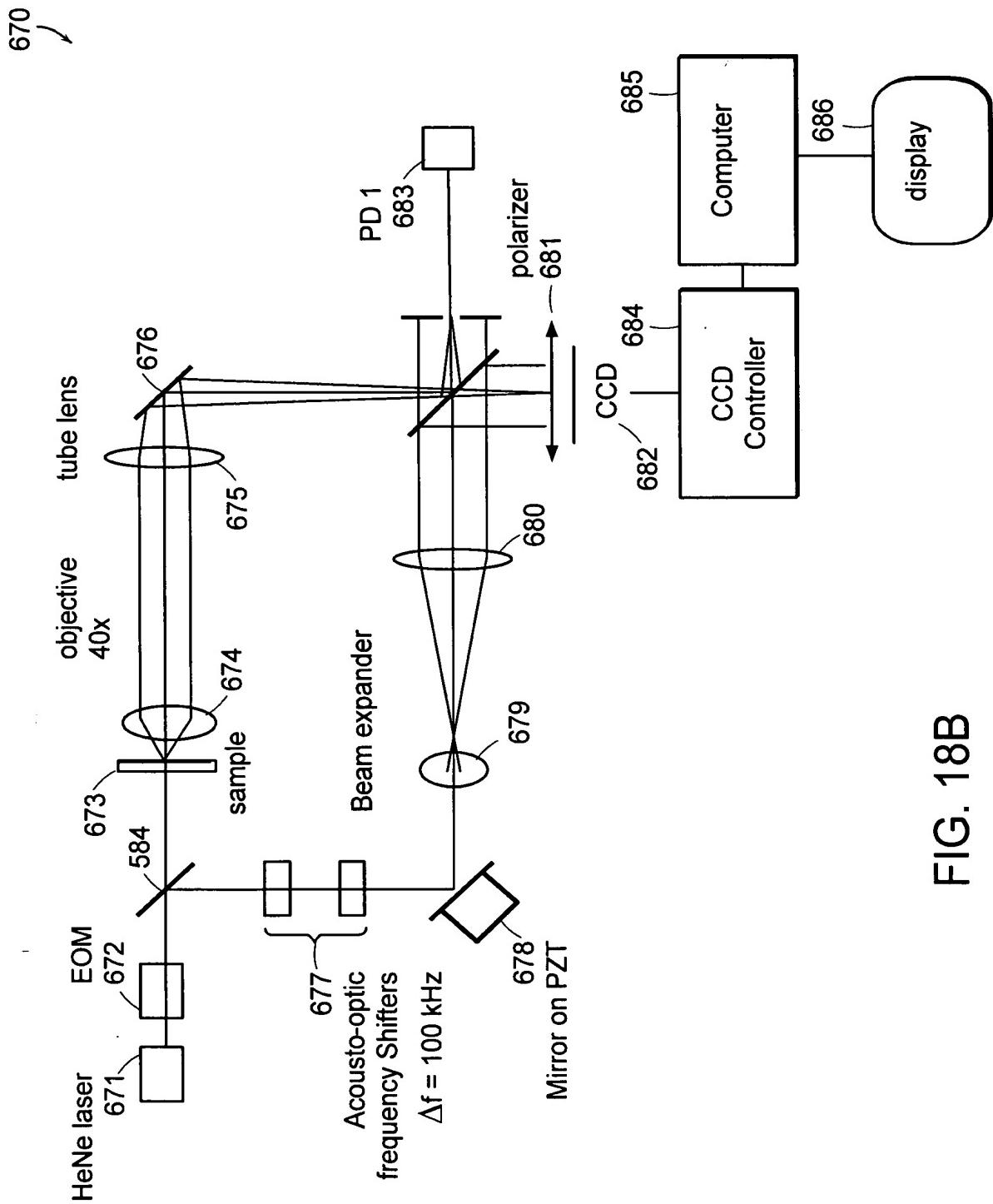


FIG. 18B

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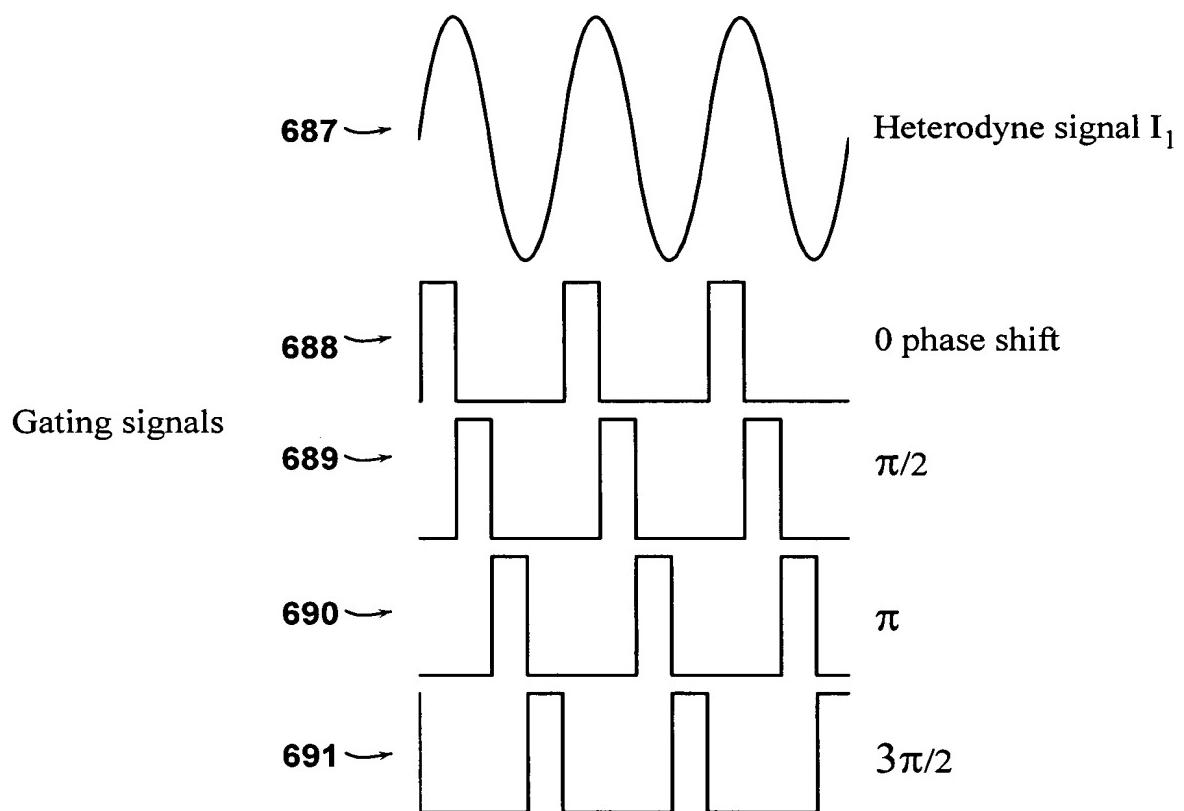


FIG. 18C

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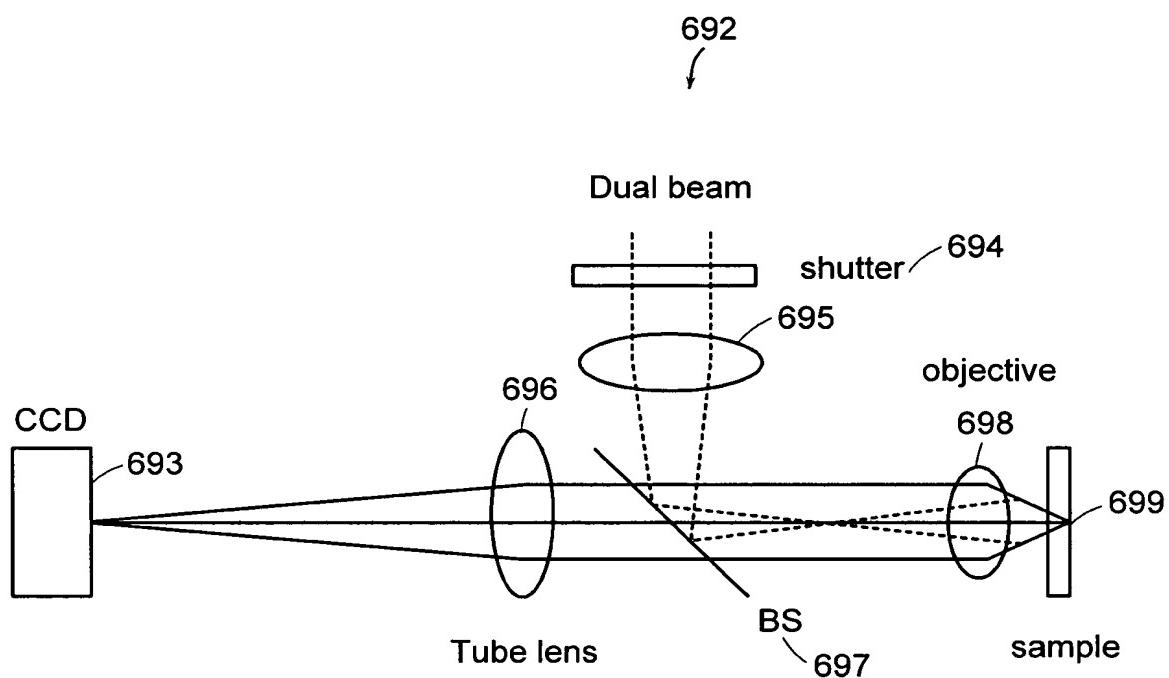


FIG. 18D

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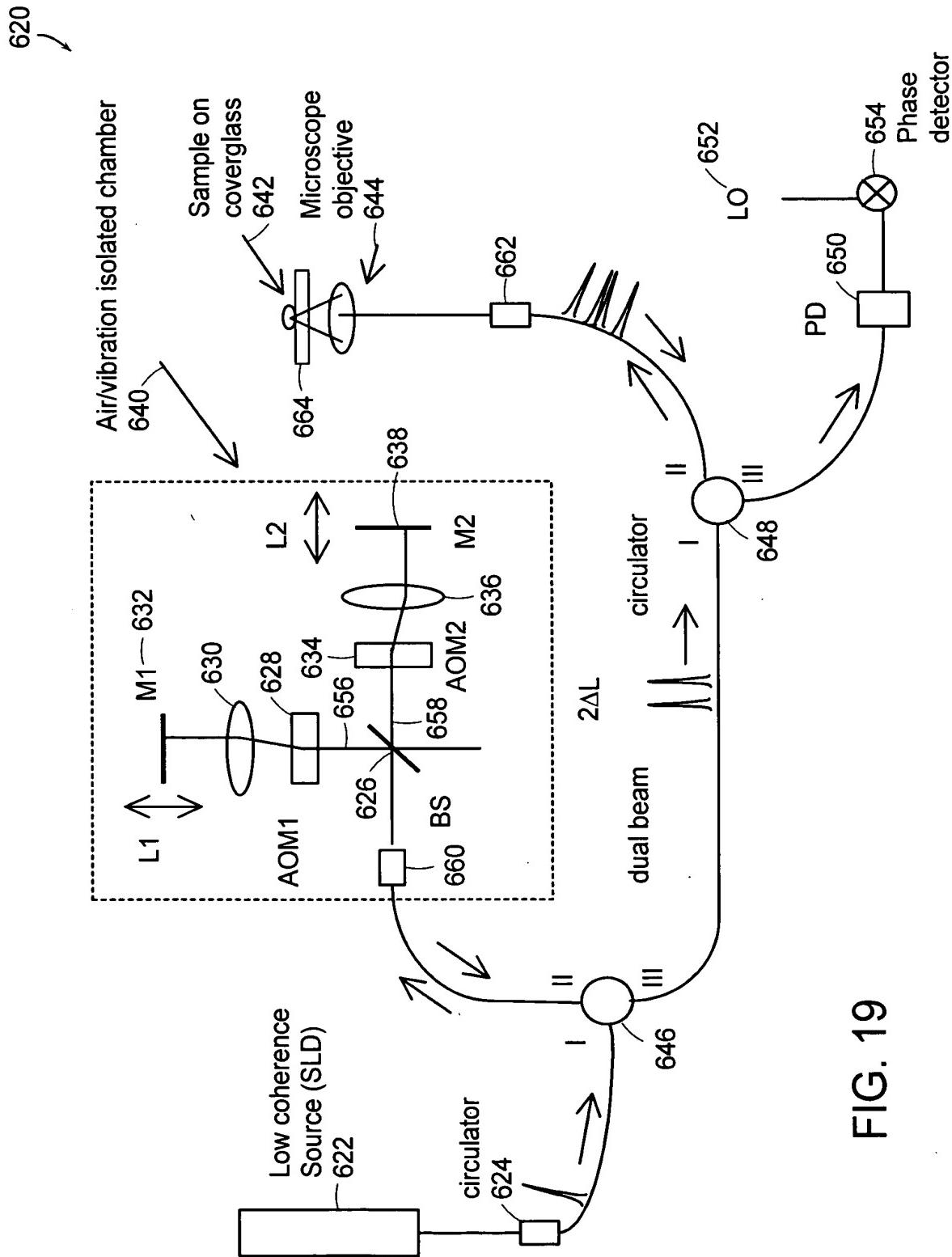


FIG. 19

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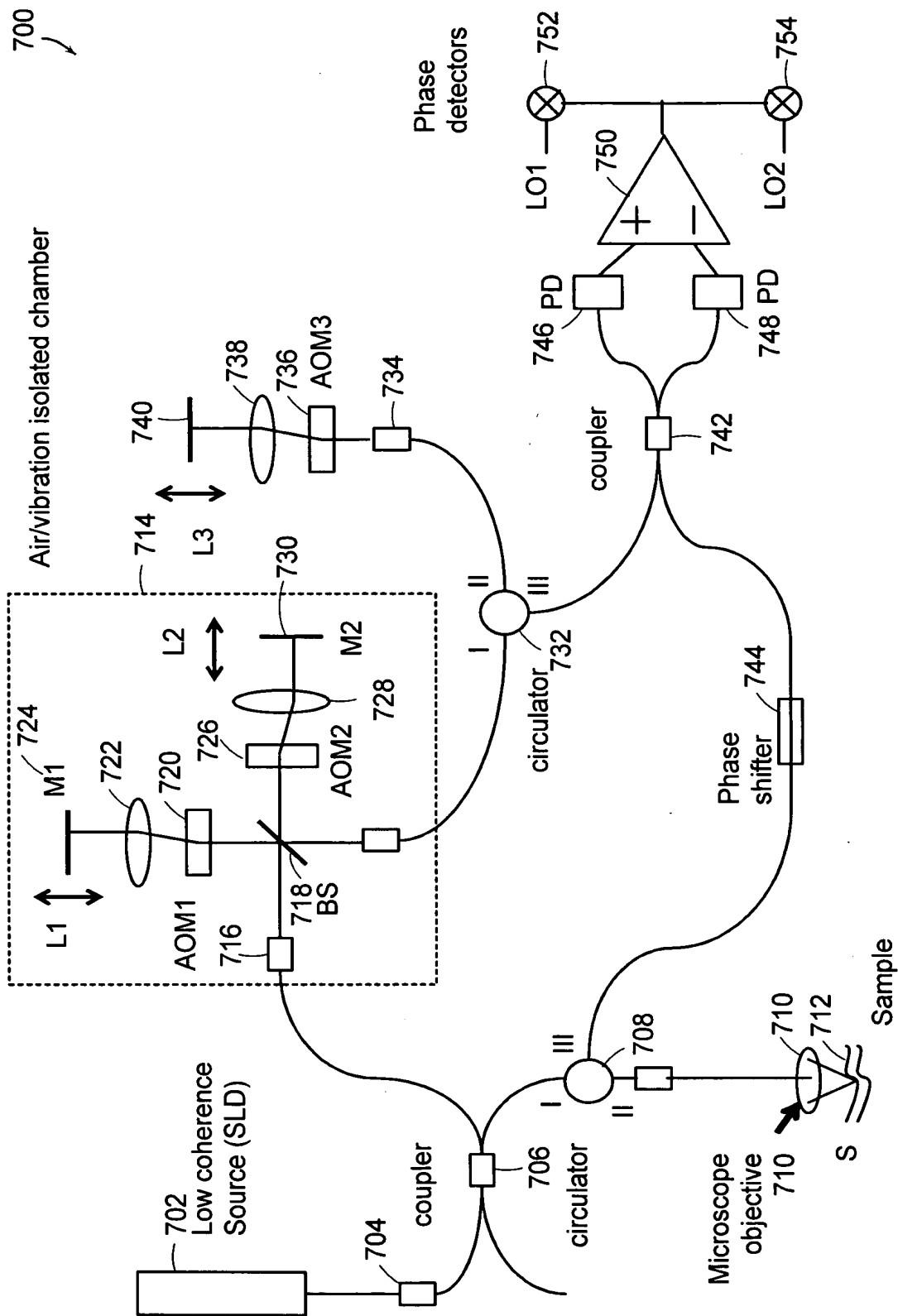


FIG. 20

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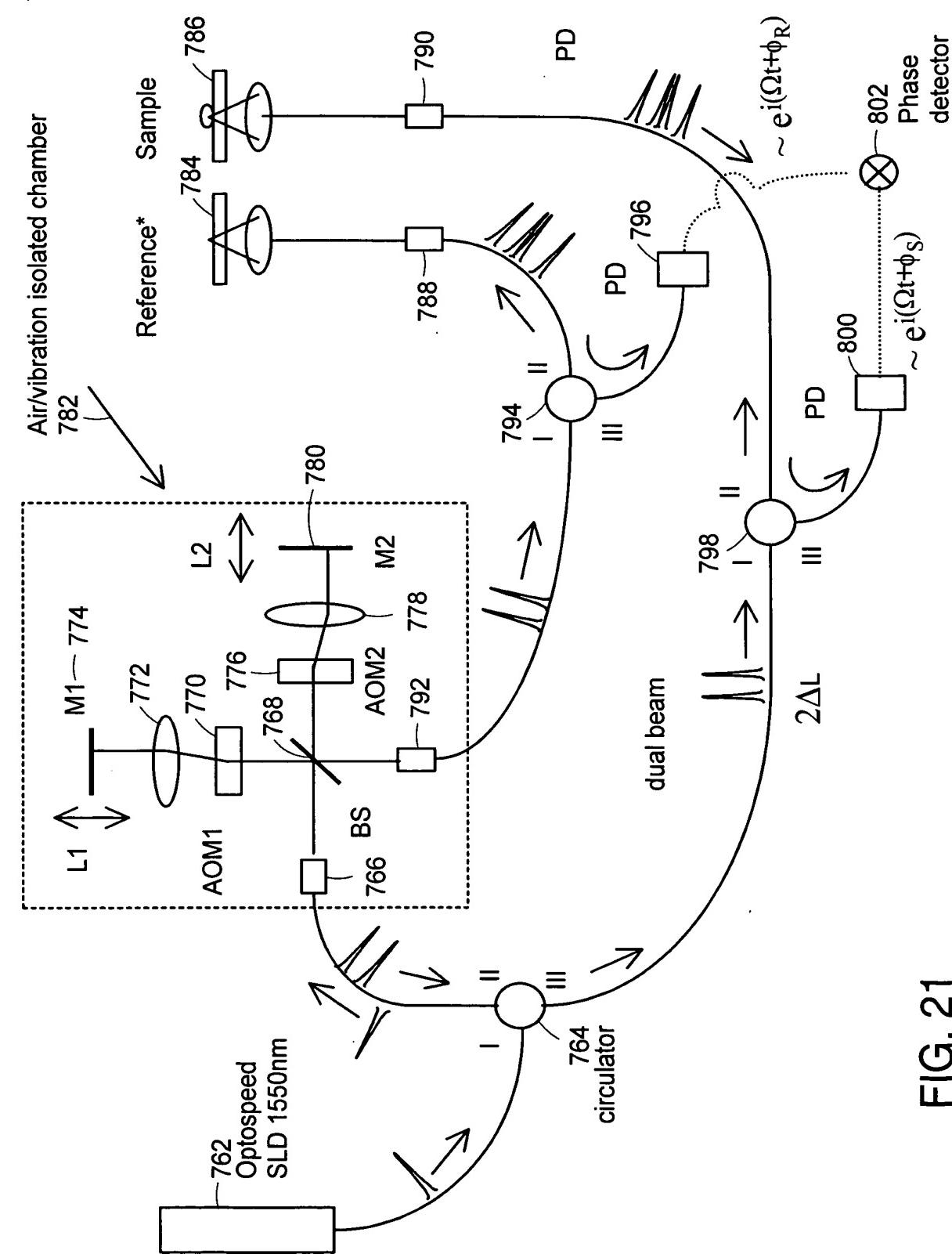


FIG. 21

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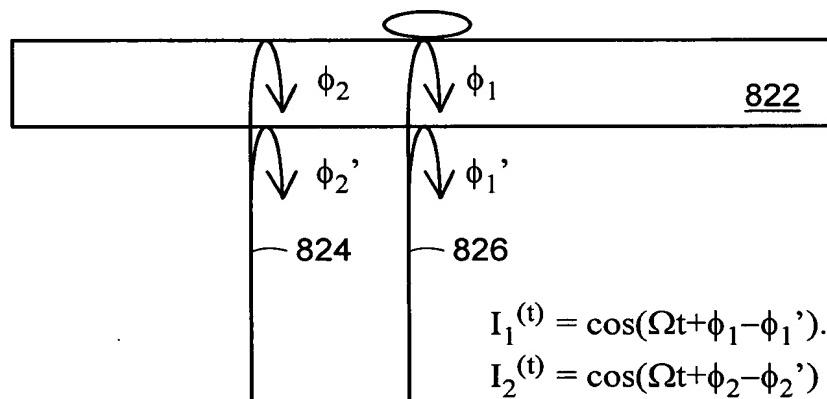


FIG. 22

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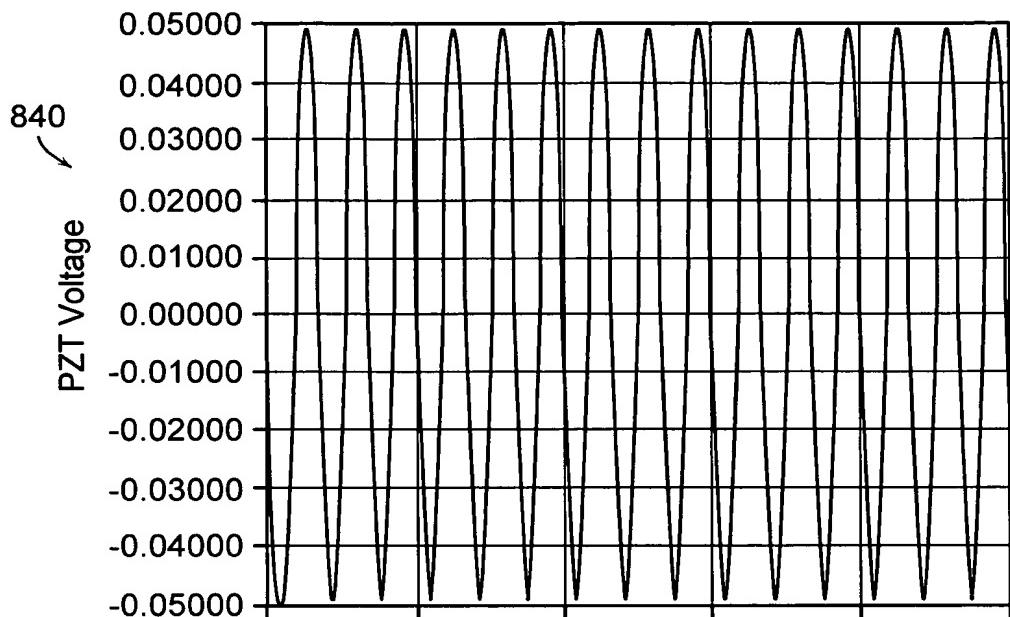


FIG. 23A

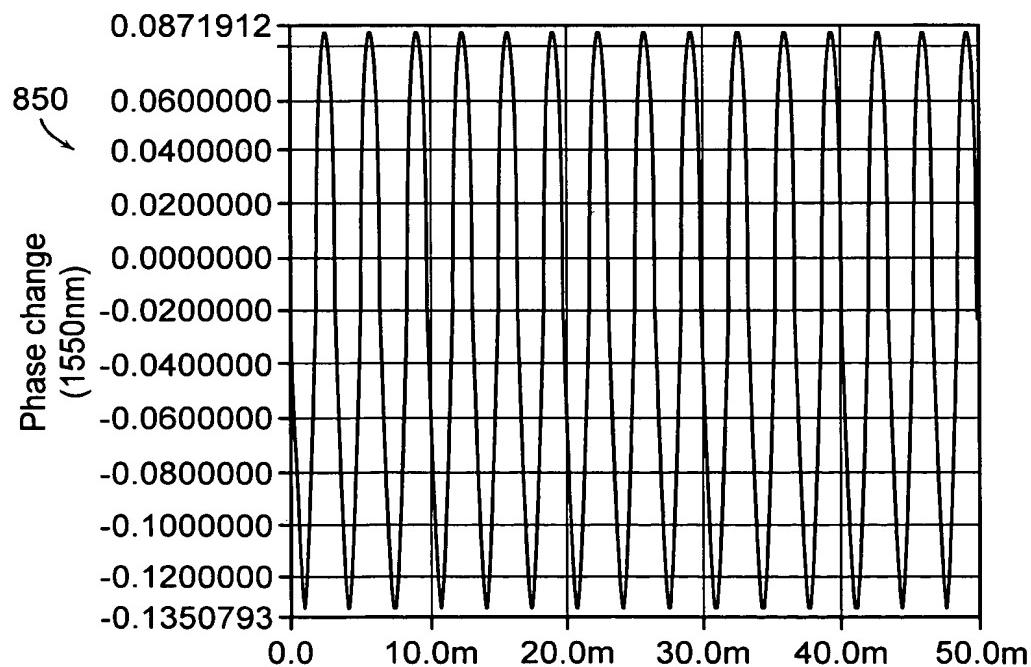


FIG. 23B

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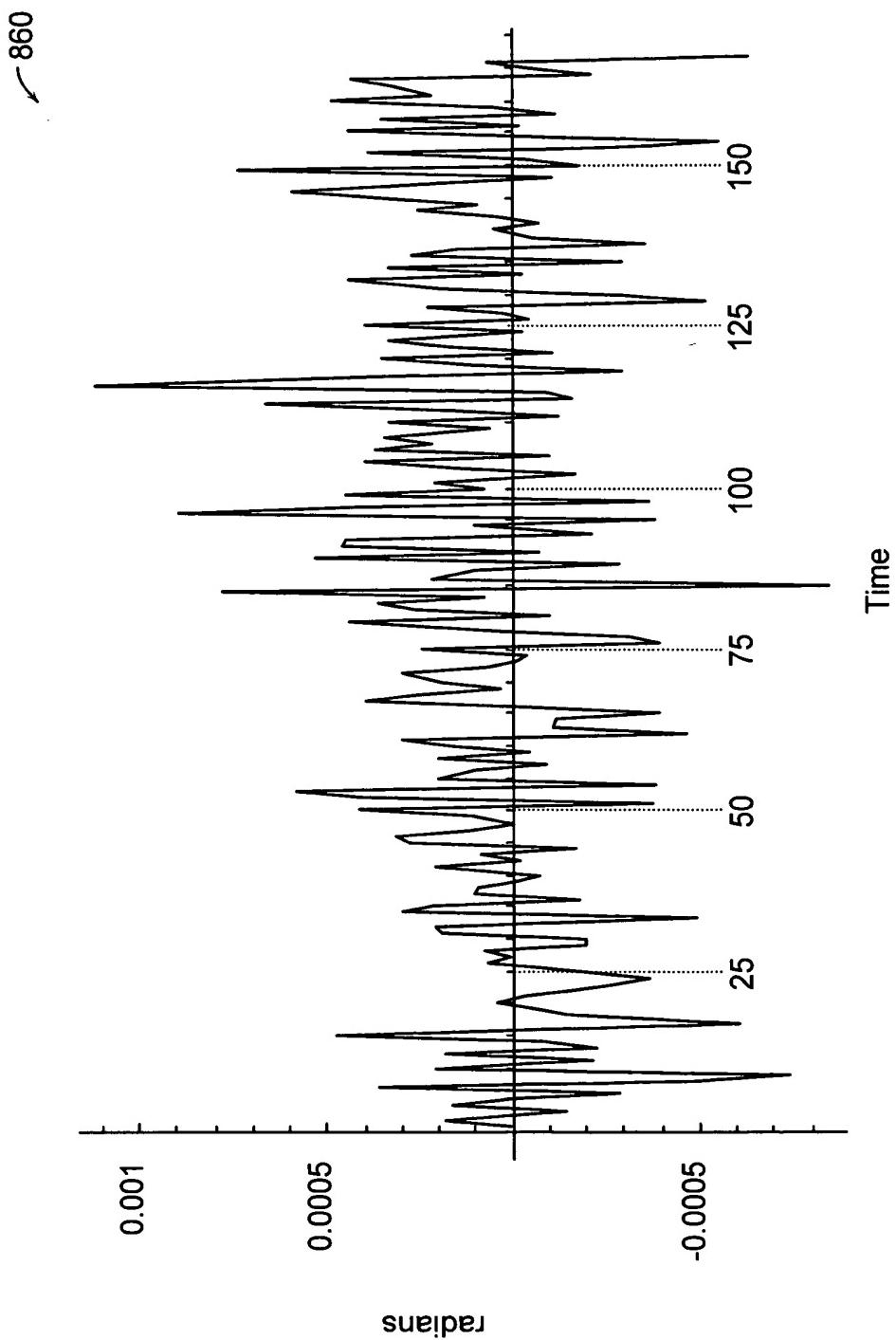


FIG. 24

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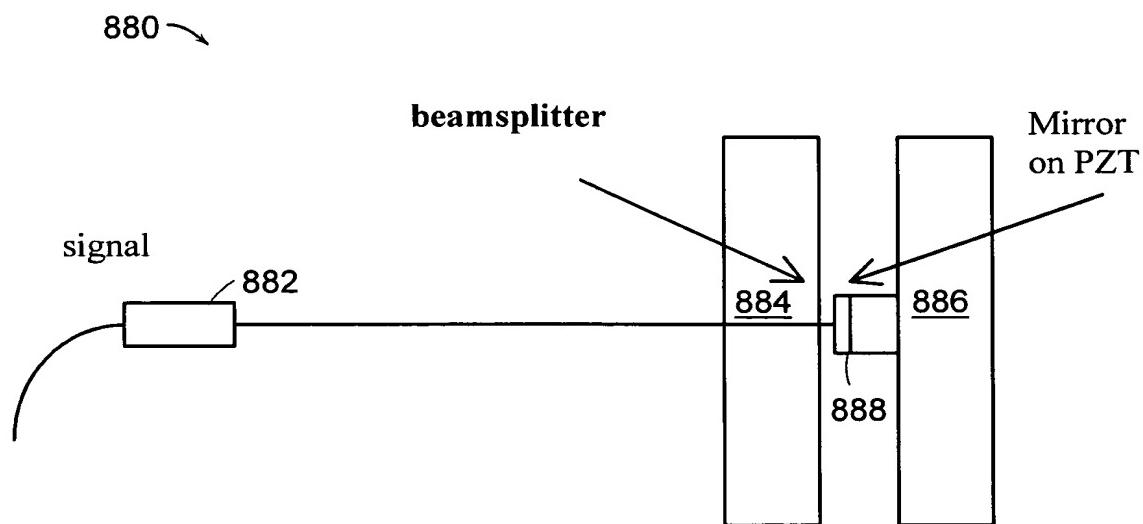


FIG. 25A

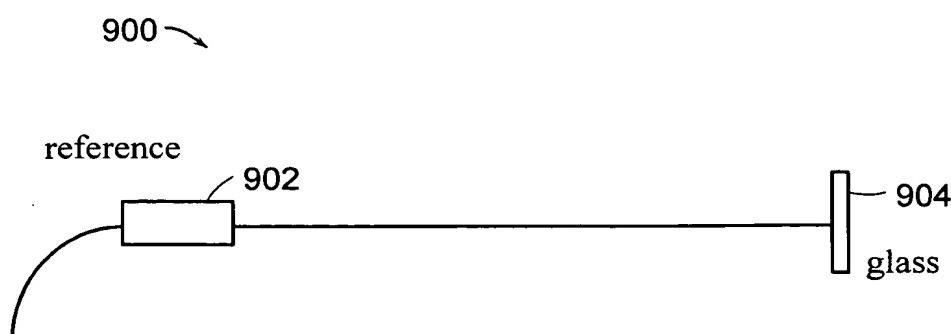


FIG. 25B

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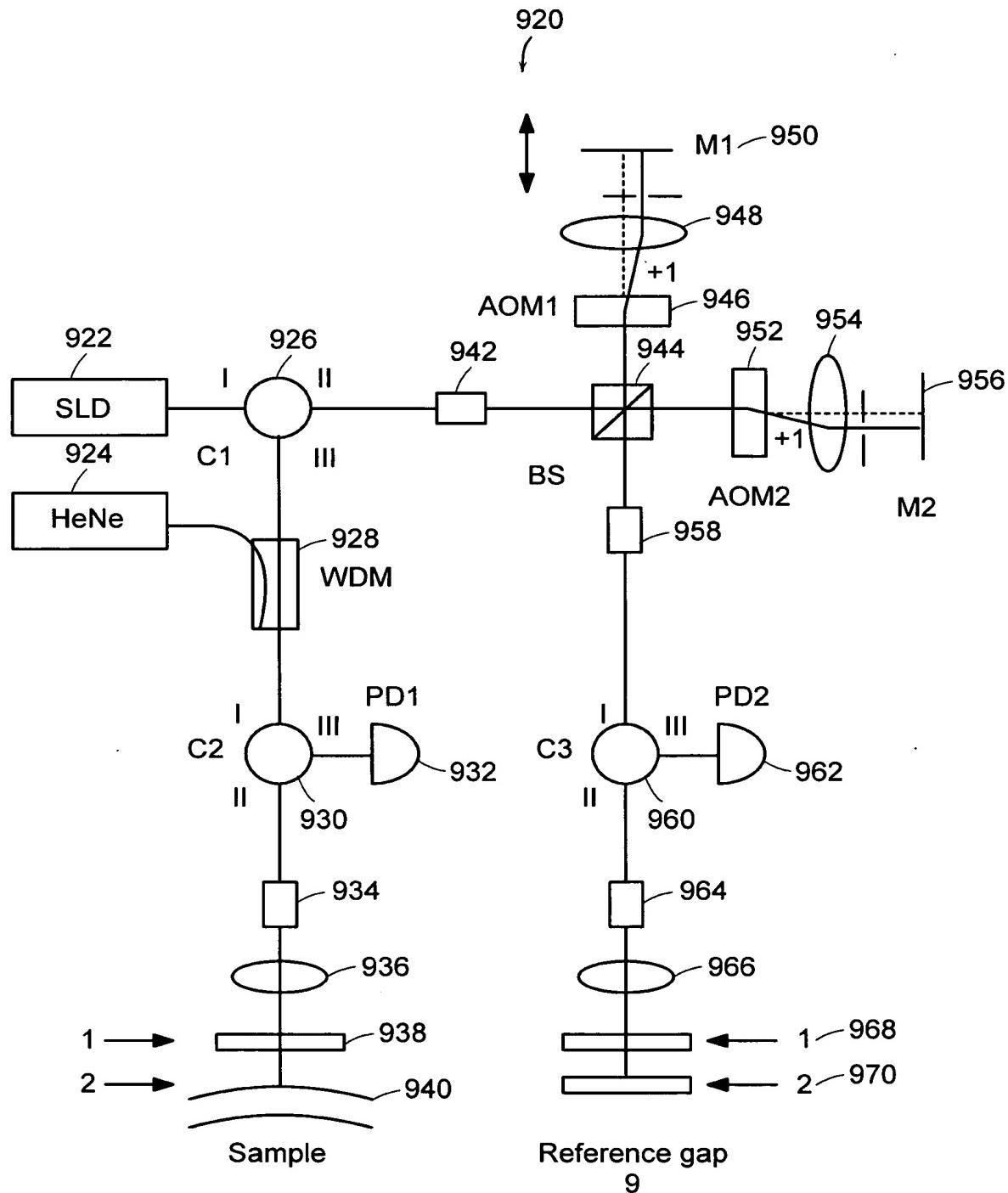


FIG. 26

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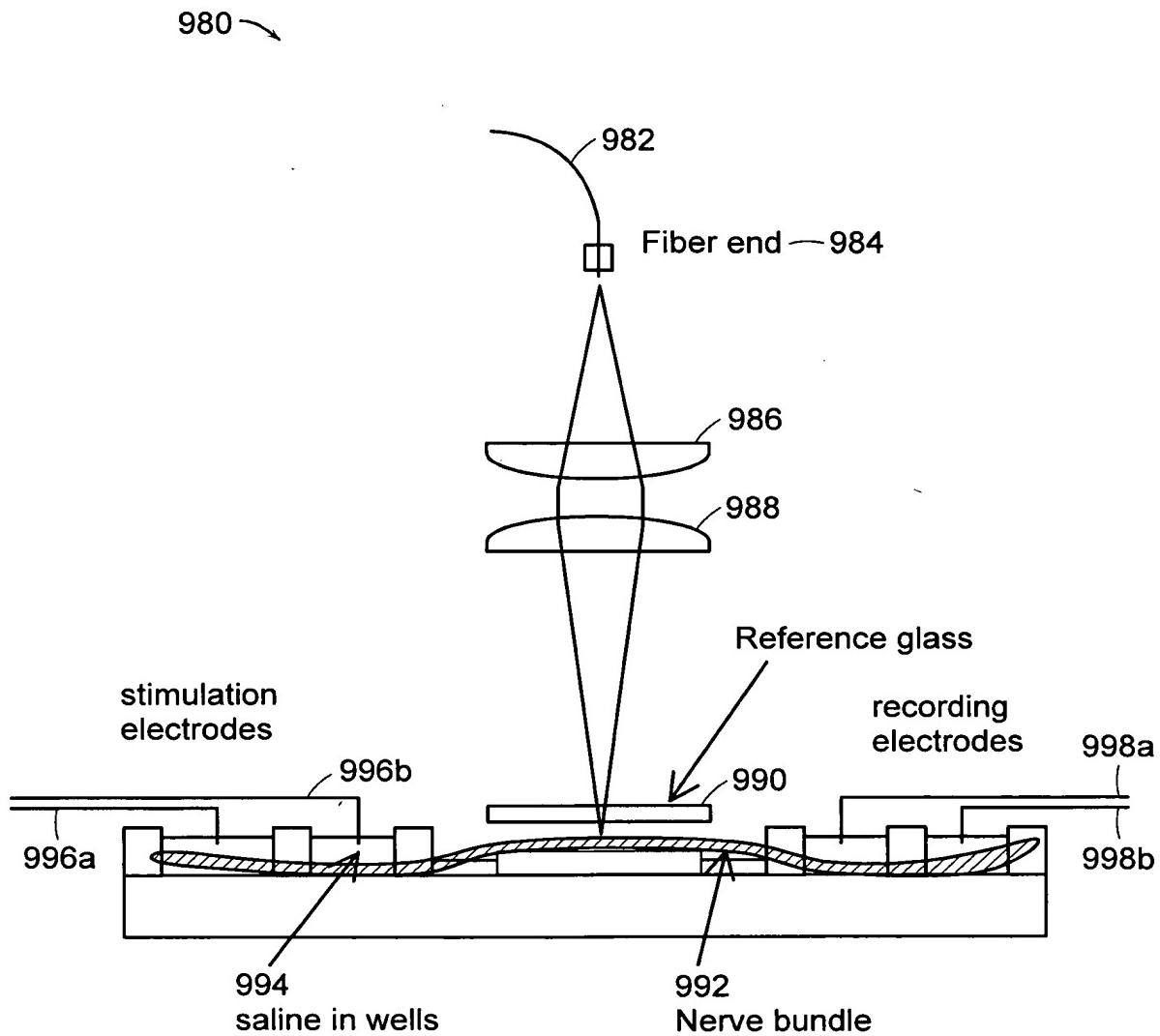


FIG. 27

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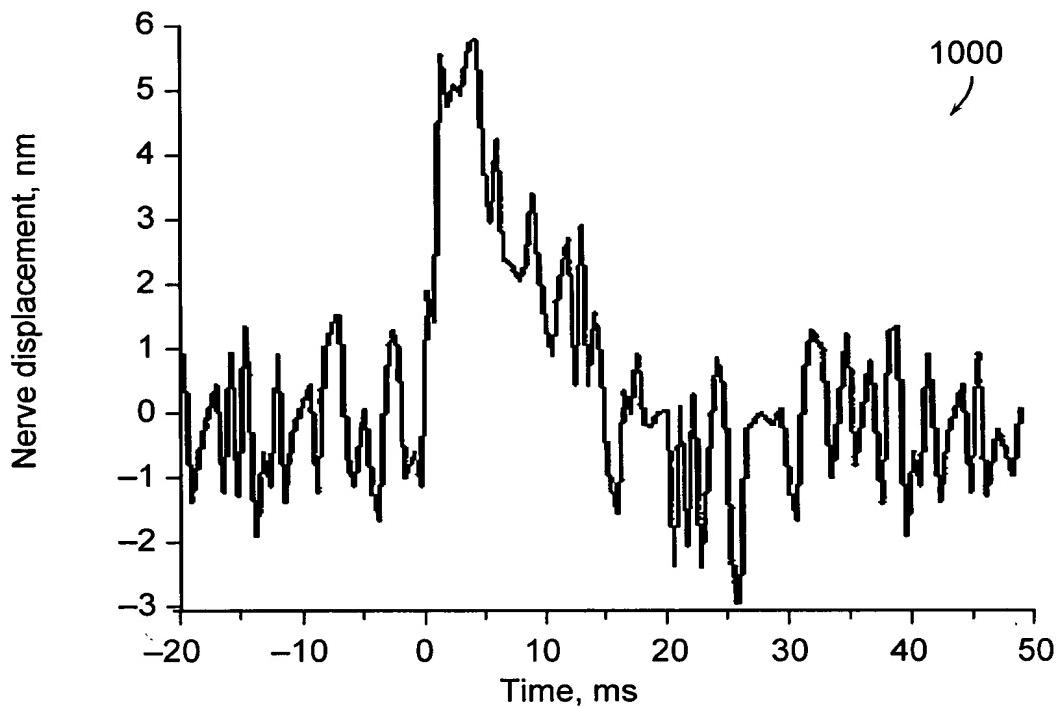


FIG. 28A

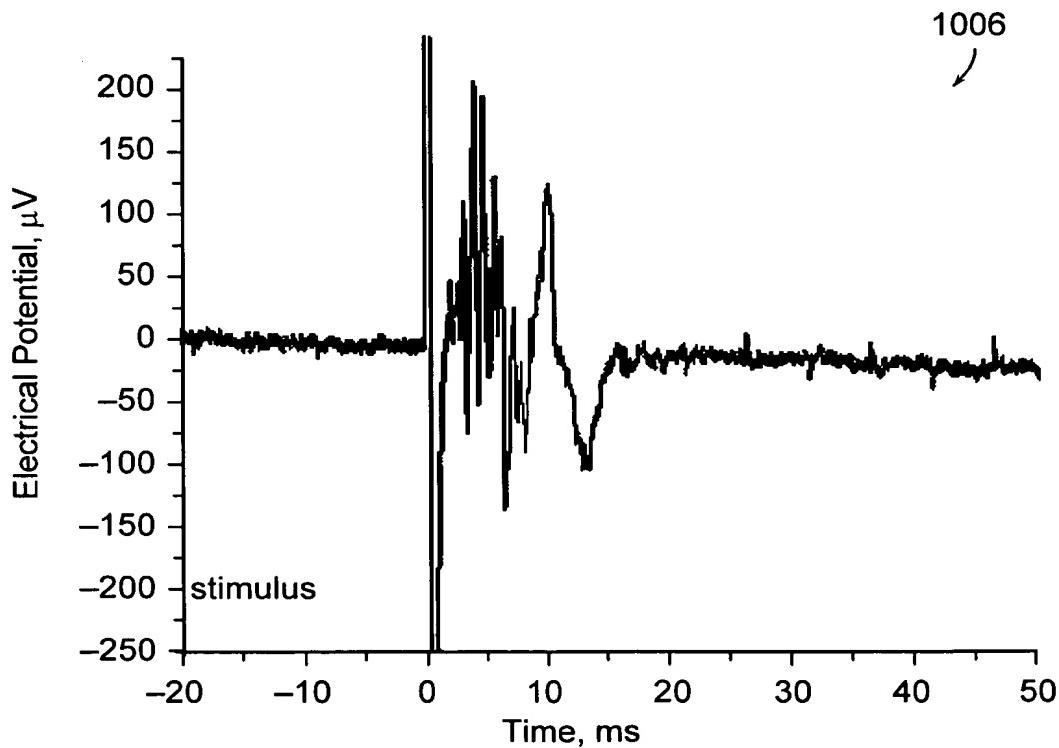


FIG. 28B

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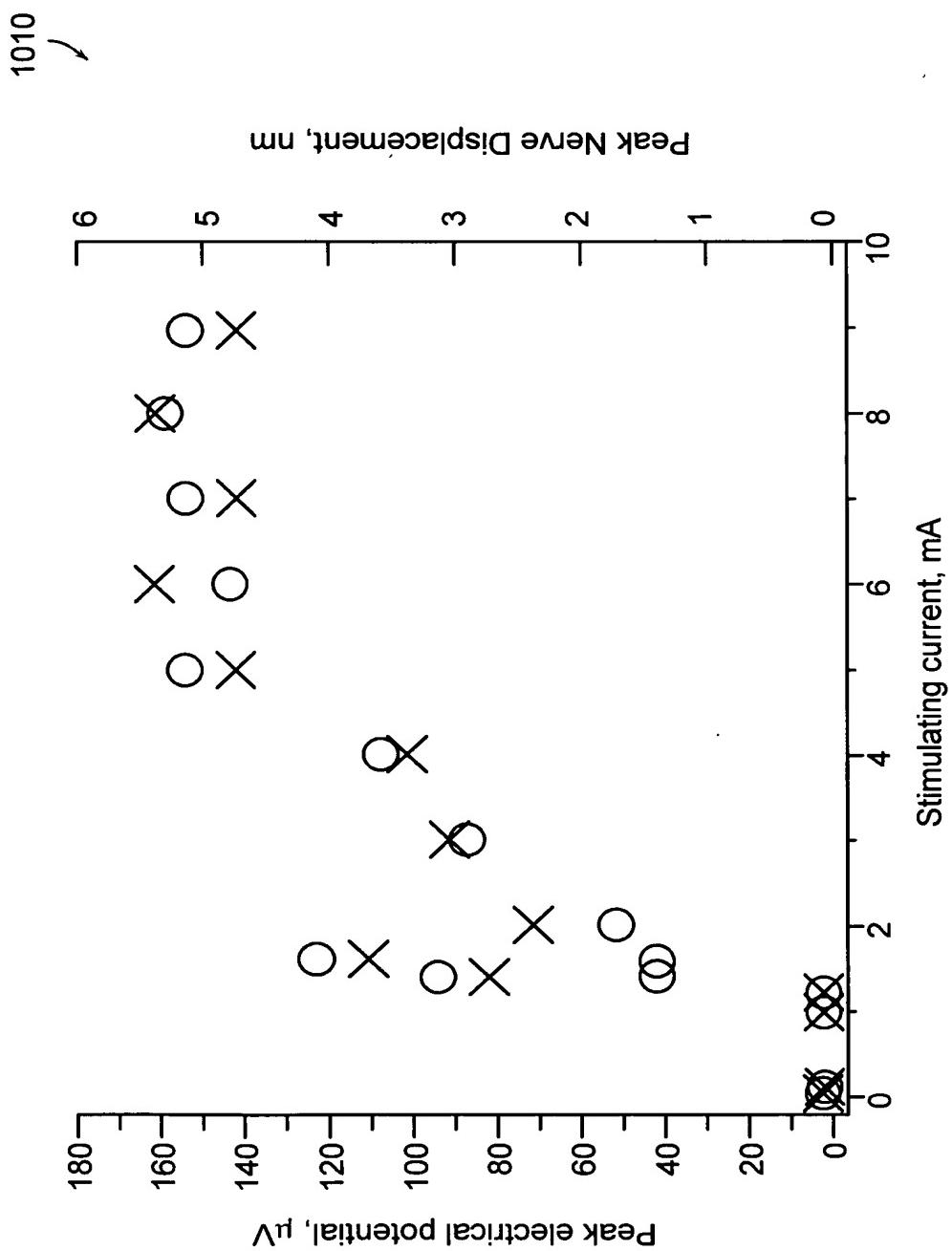


FIG. 29

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1020
↓

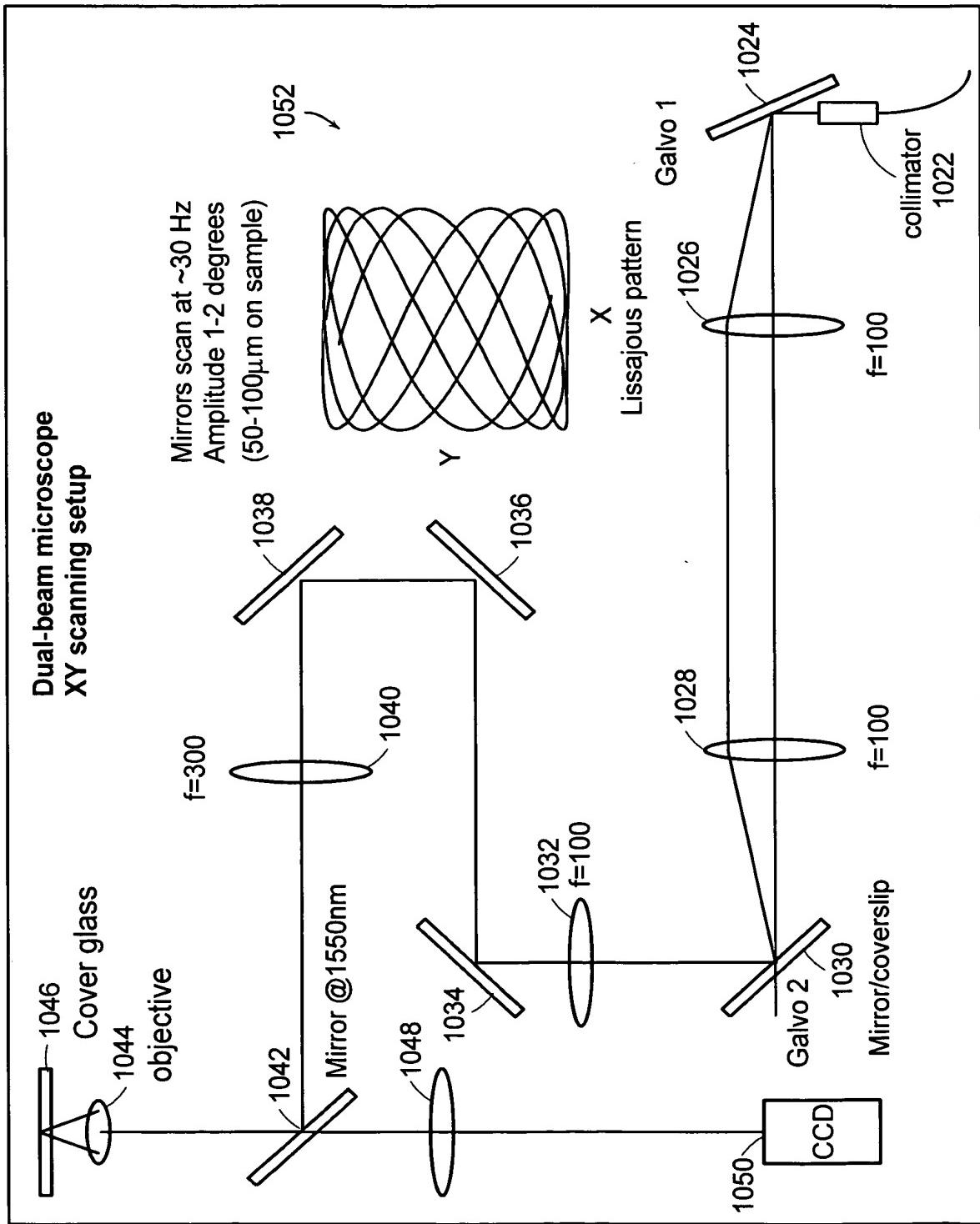


FIG. 30

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1070
J

Beam scanning data from a blank coverglass. Noise ~25 mrad over 1kHz

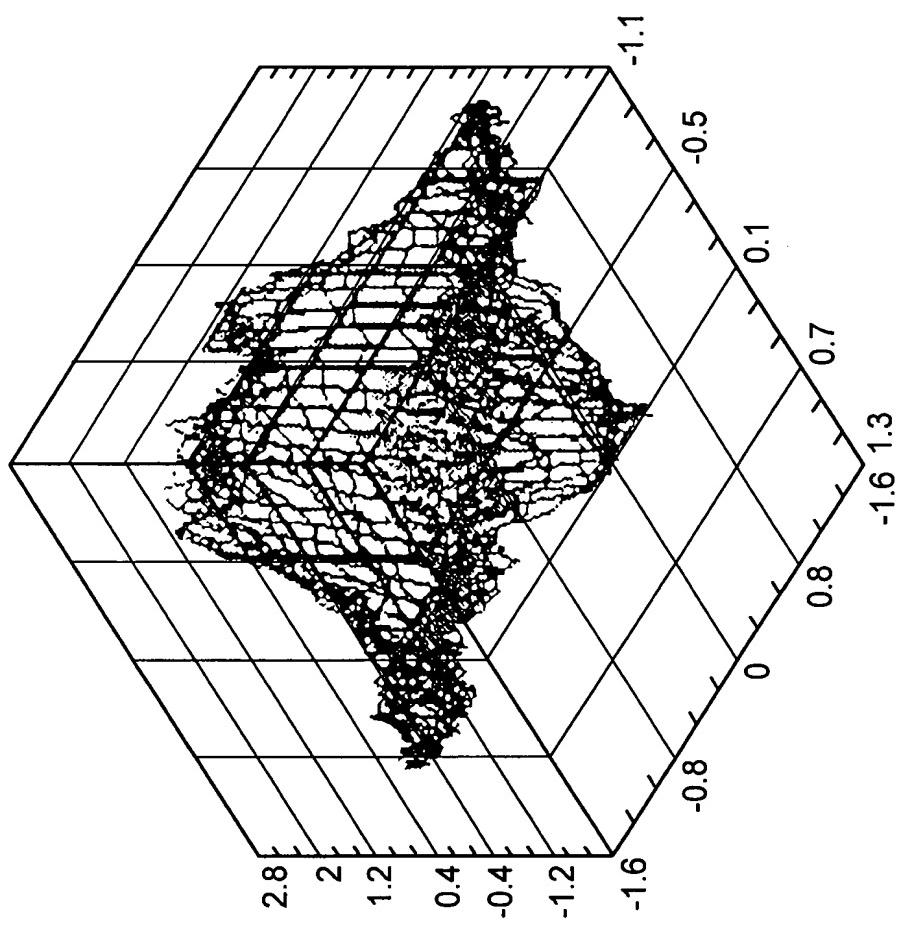


FIG. 31

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Beam scanning data from a blank coverglass. Noise ~25 mrad over 1kHz

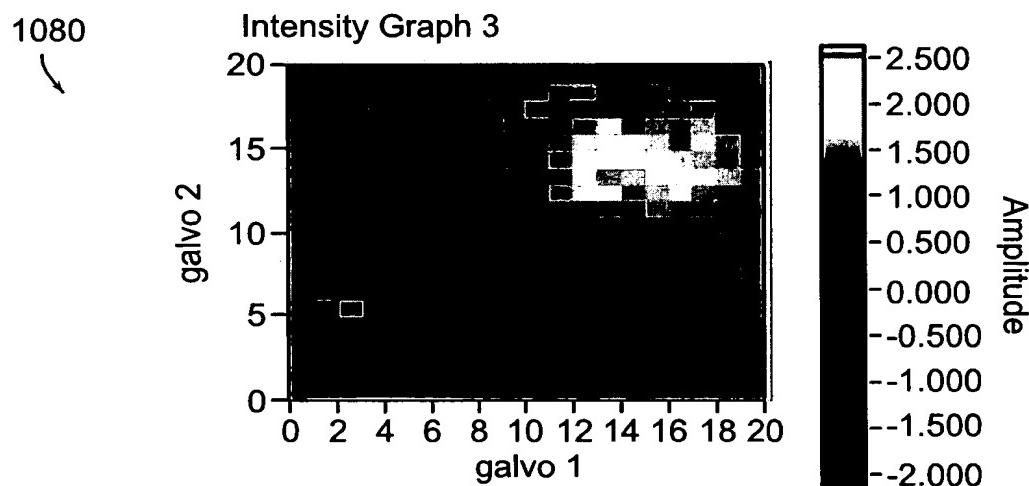


FIG. 32A

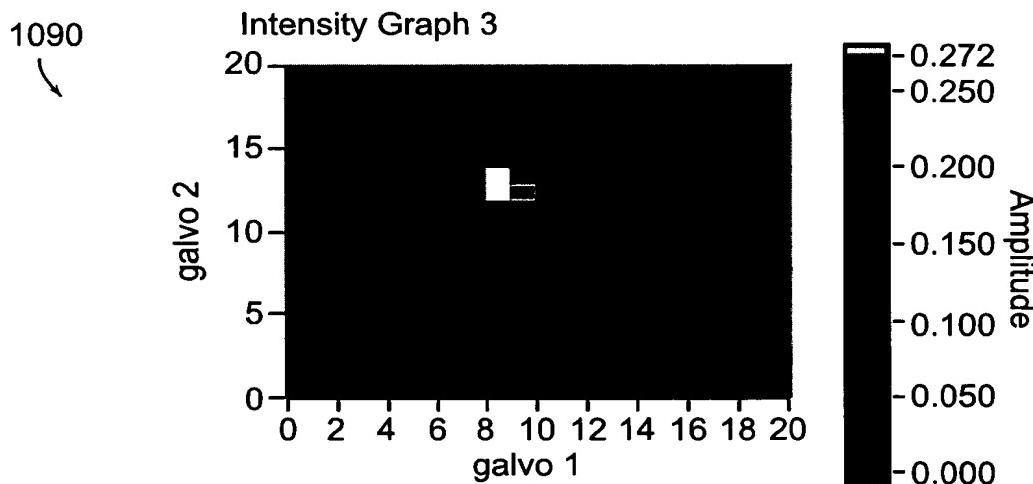


FIG. 32B

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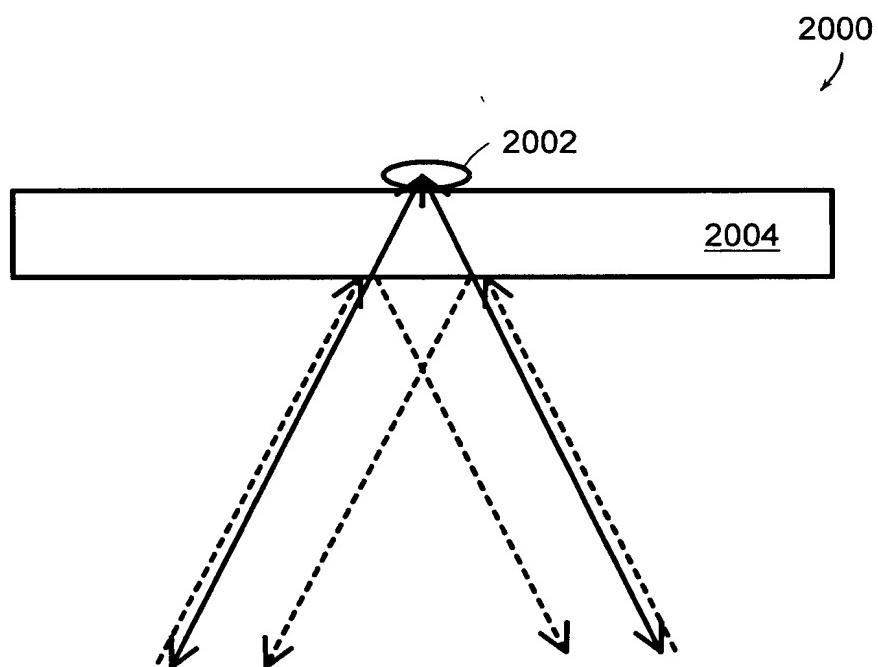


FIG. 33

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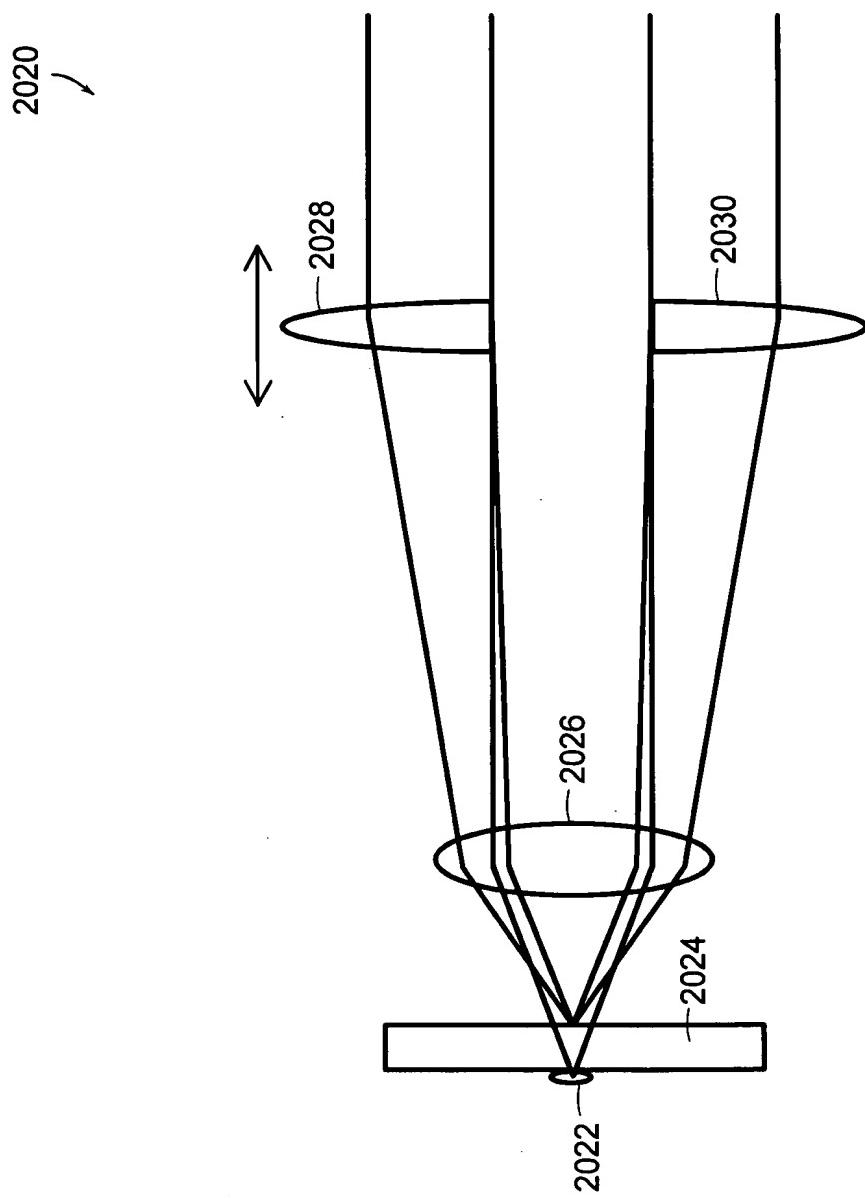


FIG. 34

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2050
J

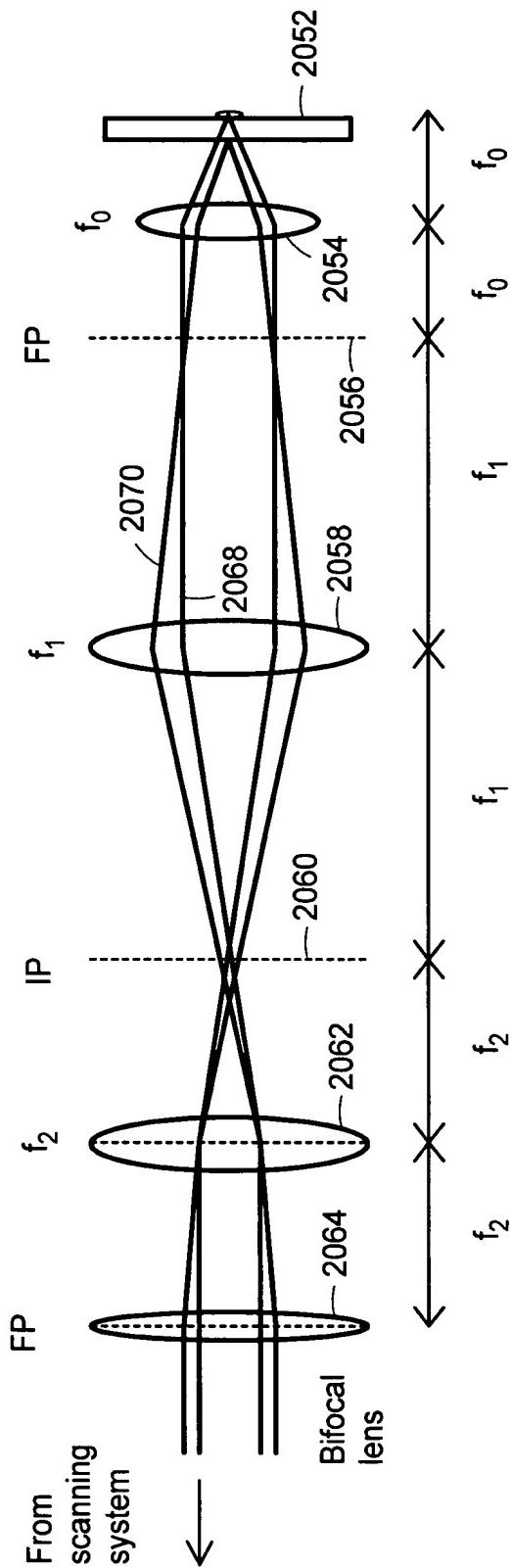


FIG. 35

2080
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Optical design by ray tracing

```

= f0 = 6.4;
f1 = 300;
f2 = 100;
f3 = 50;
delta = .1;

x0 = f0;
x1 = 2 f0 + f1;
x2 = 2 f0 + 2 f1 + f2;
x3 = 2 f0 + 2 f1 + f2;

na = 0.4;

(* TRANSFER AND LENS MATRICES *)
t[z_] := {{1, z}, {0, 1}};
lens[f_] := {{1, 0}, -1/f, 1};

delta = .1;
soln =
Solve[
(t[z0 - delta] . lens[f0] . t[a1 - z0] .
lens[f1] . t[z2 - z1] . lens[f2] .
t[d3var] . lens[f3].
{.6 wmax, 0}) [[1]] - 0, f3var]

```

Out[246] = {{d3var → 104.489}}

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Distance between f3 and f2 in order
to shift focus by 100 microns

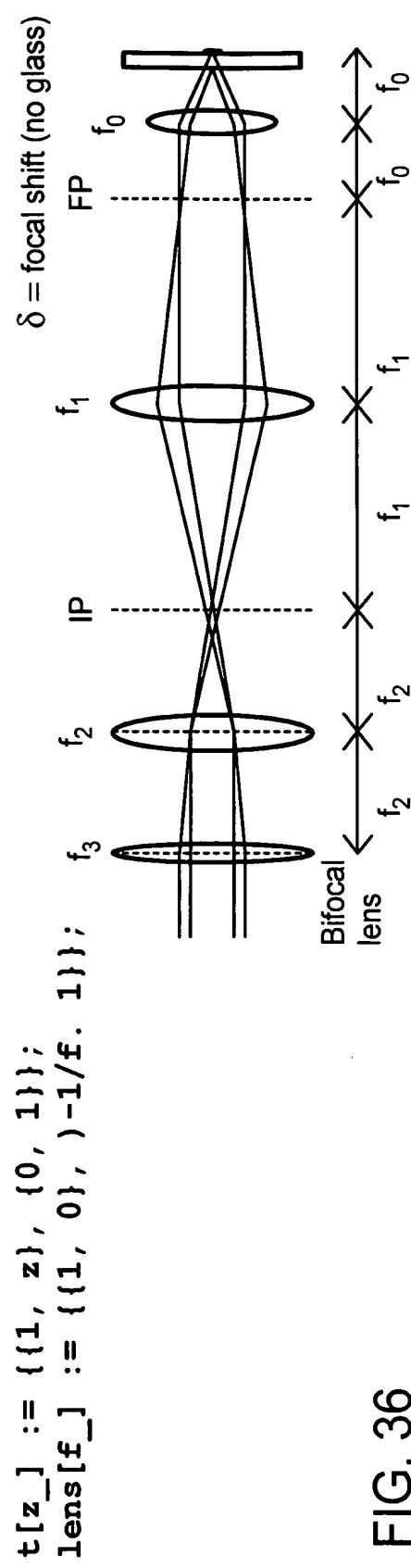


FIG. 36

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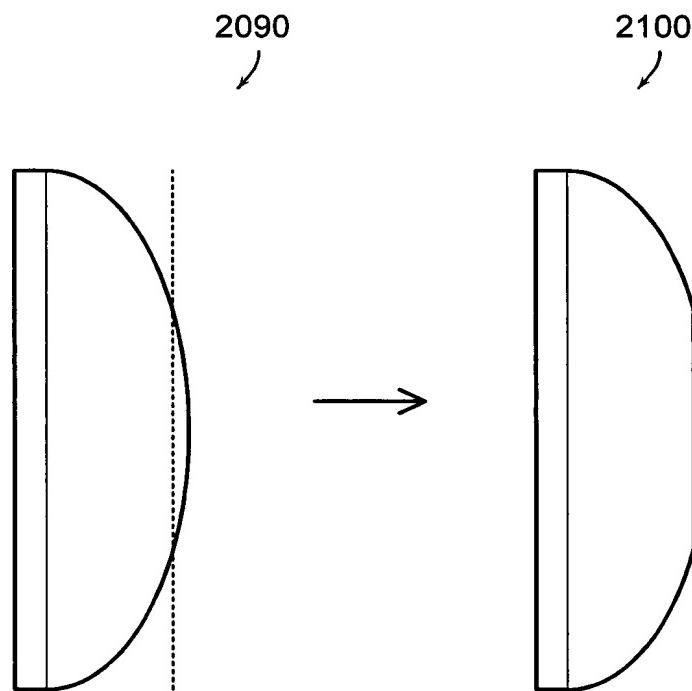
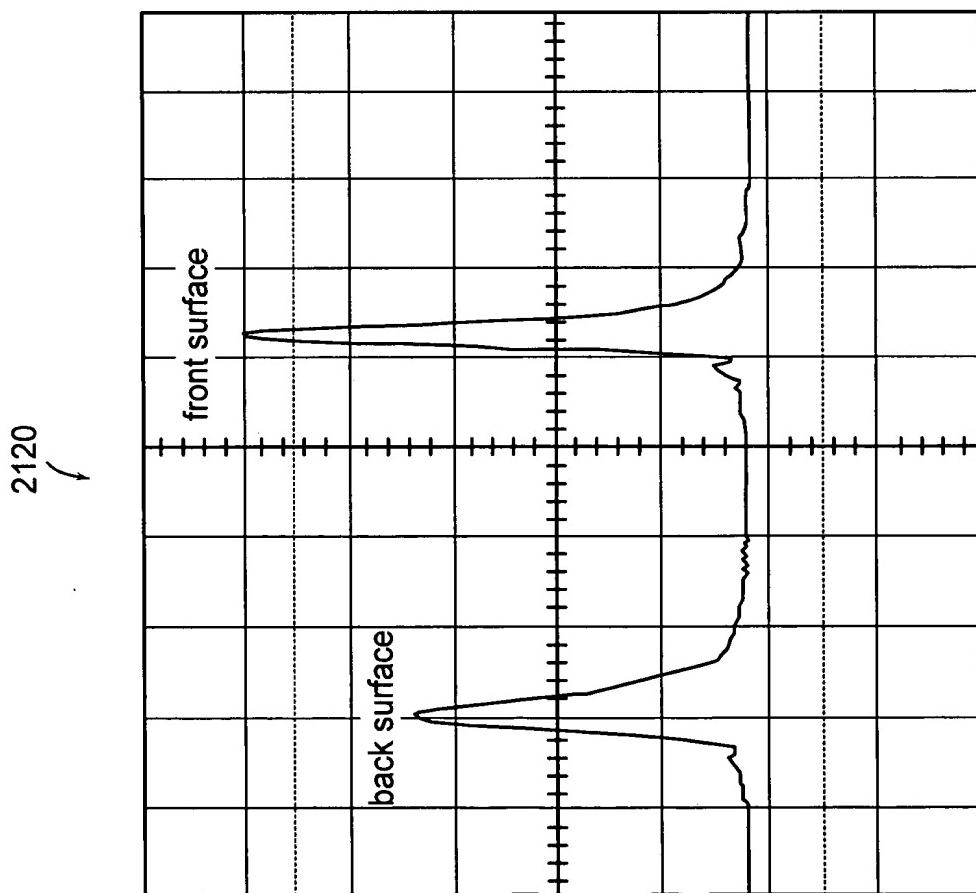
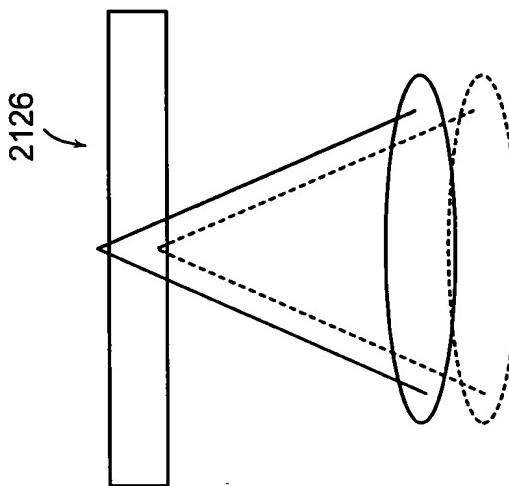


FIG. 37

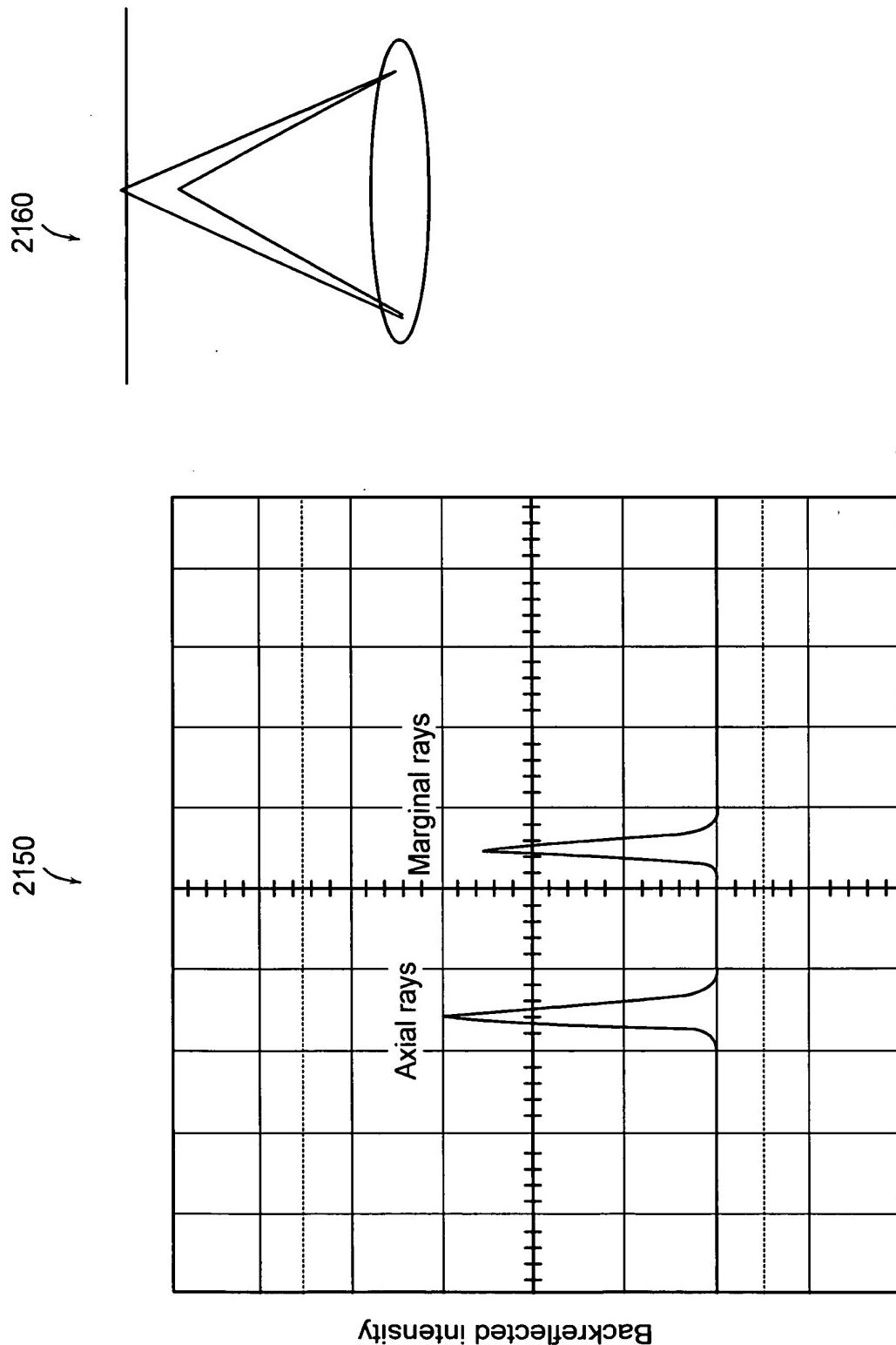
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Objective focus position

FIG. 38

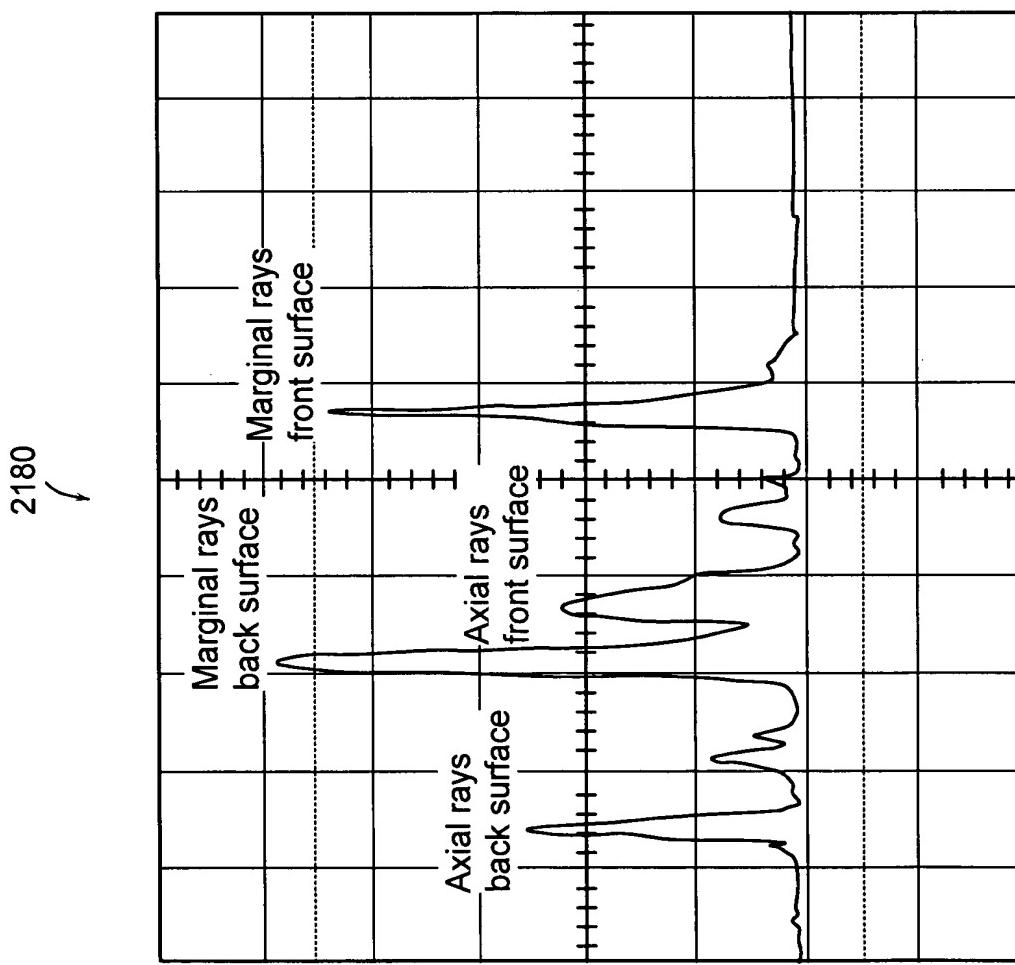
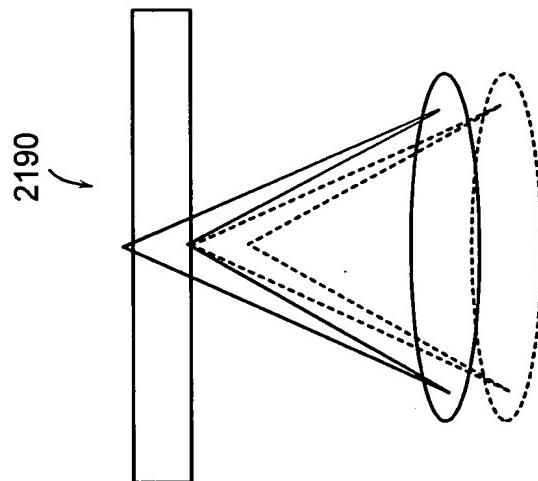
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Objective focus position

FIG. 39

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Back-reflected intensity

FIG. 40

Objective focus position

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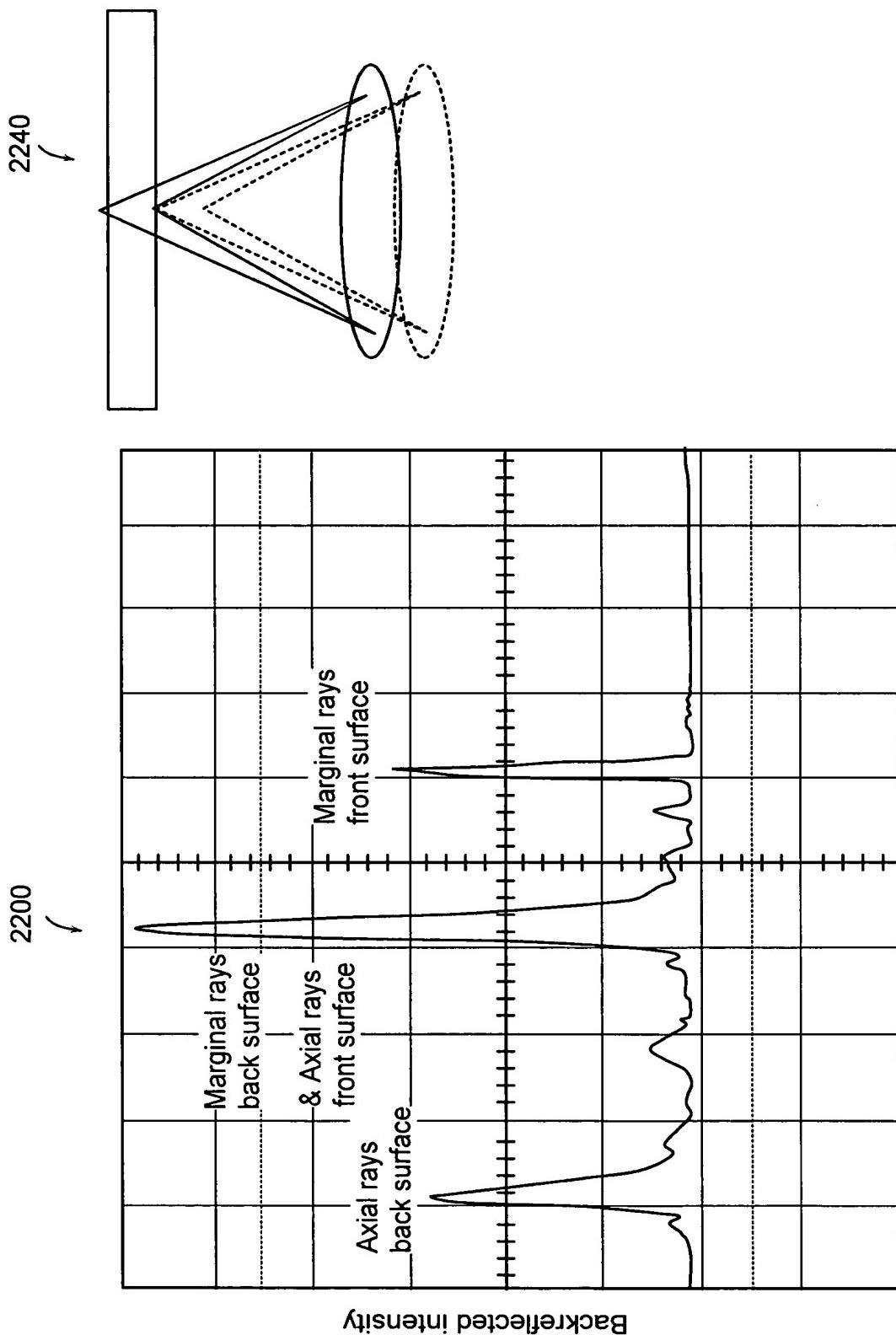


FIG. 41

Objective focus position

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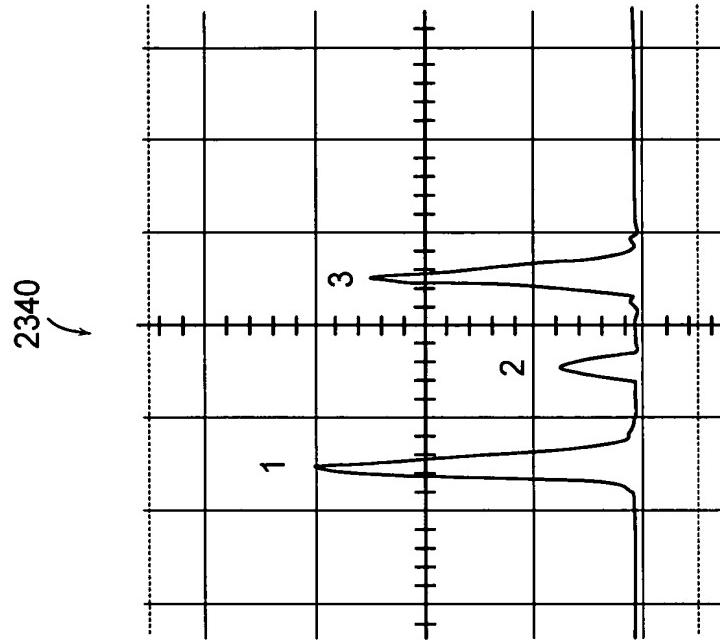


FIG. 42B

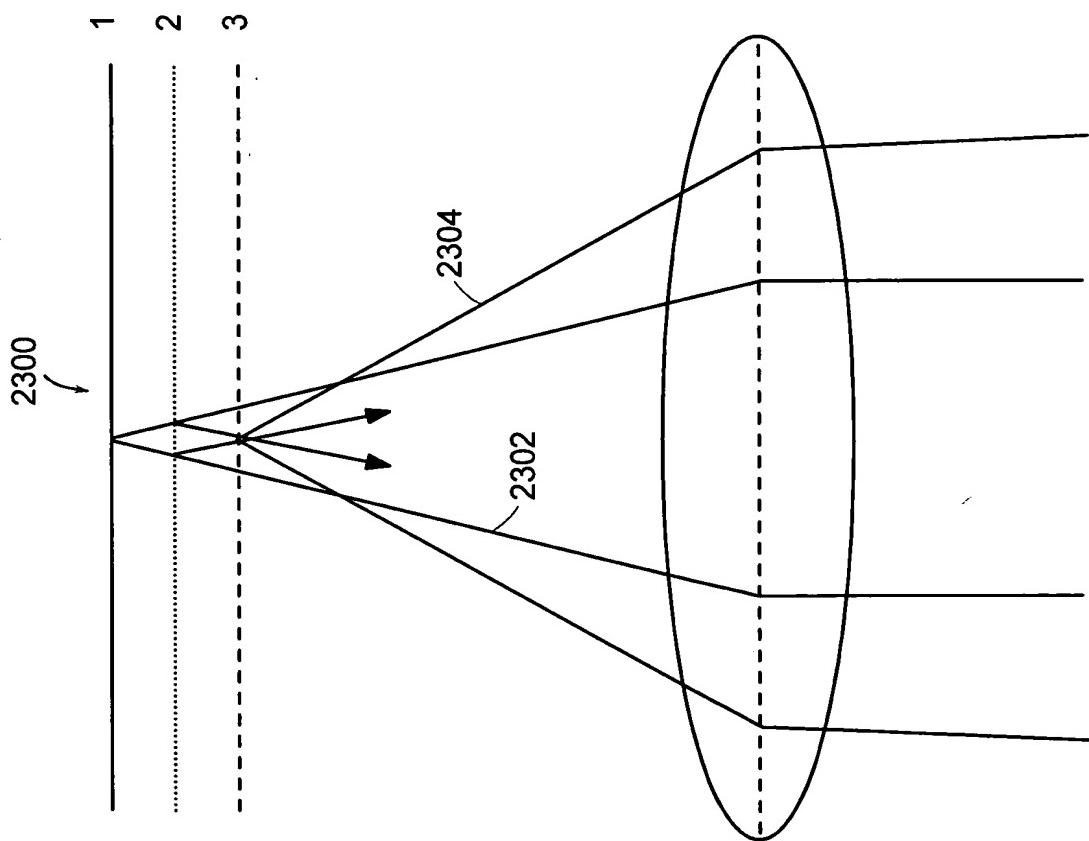


FIG. 42A

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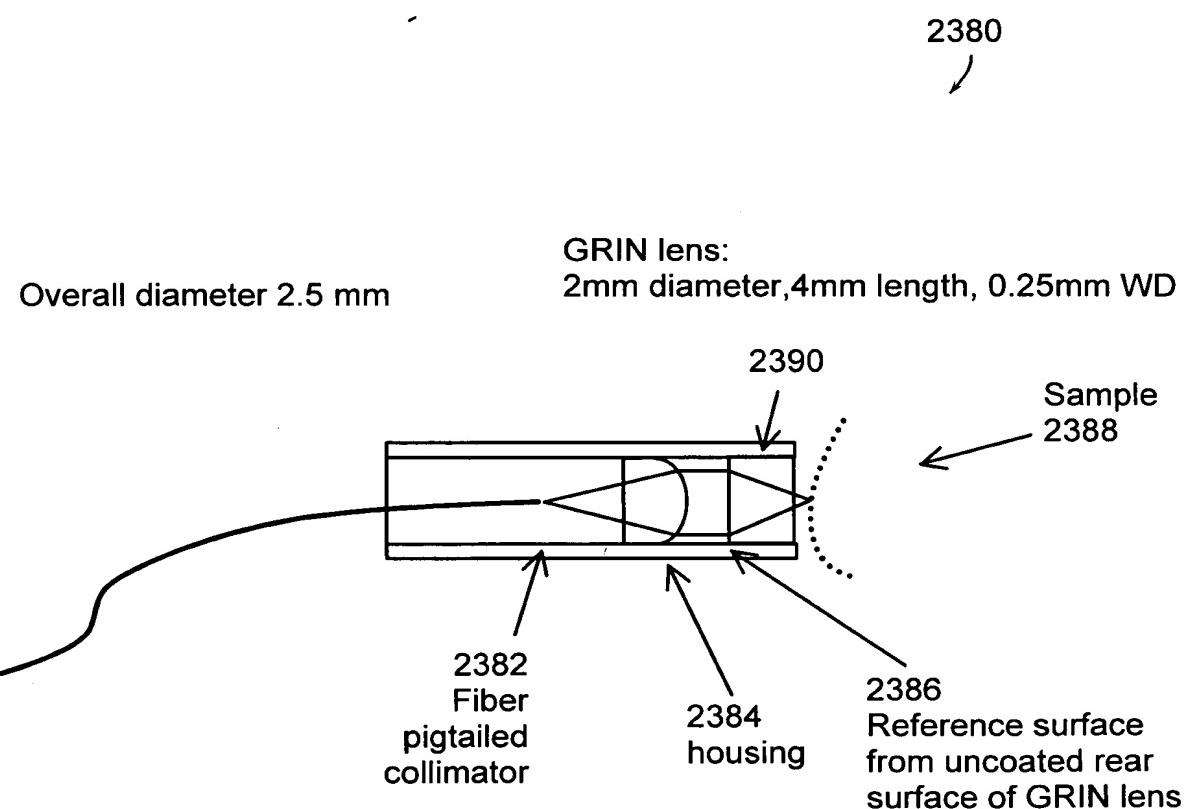


FIG. 43

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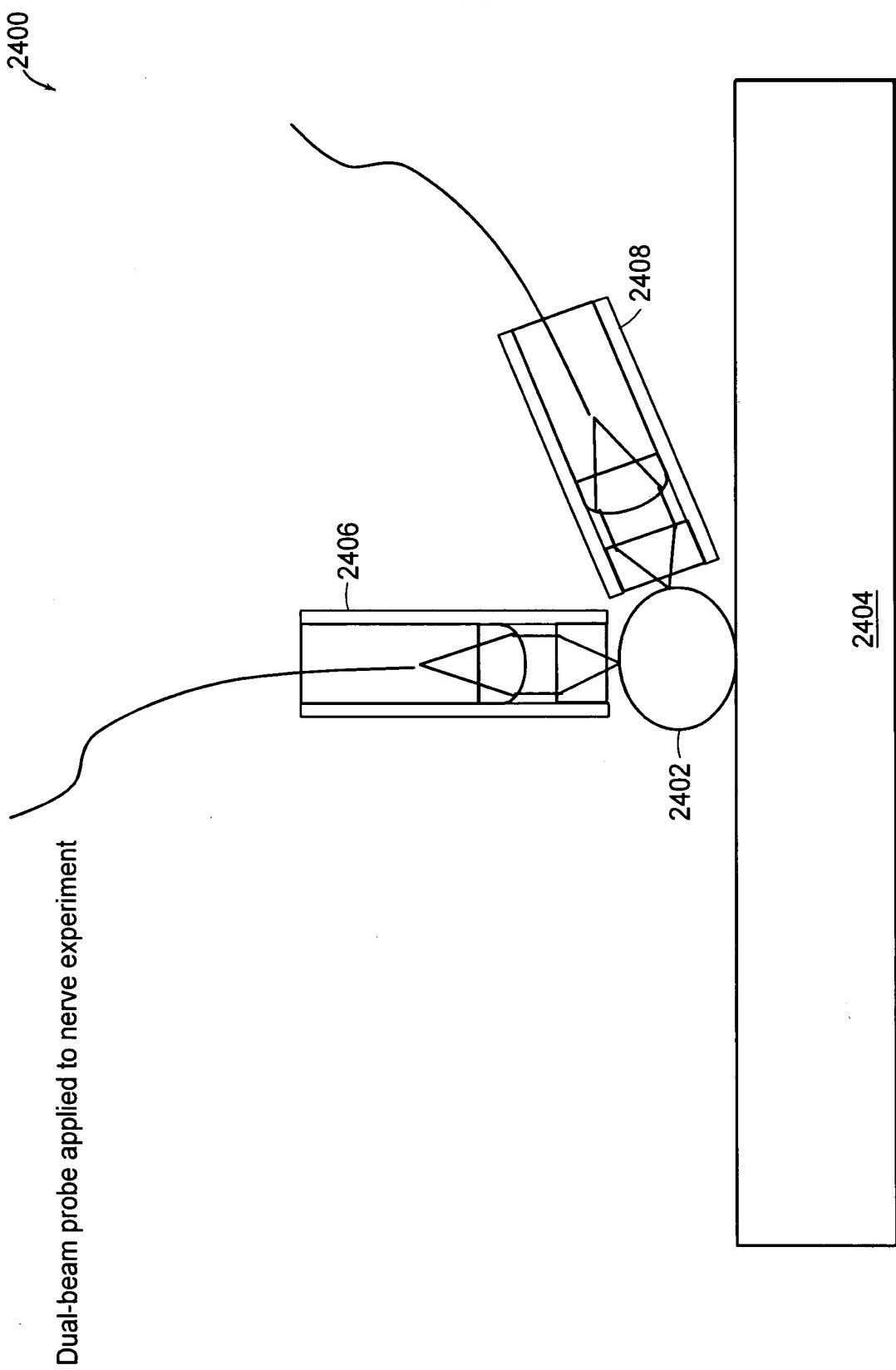


FIG. 44

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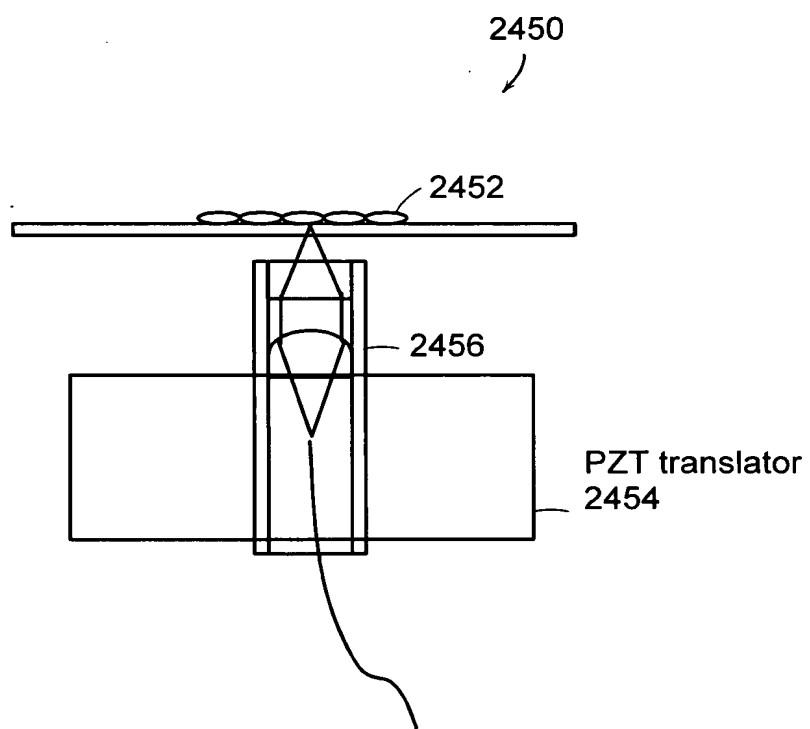


FIG. 45

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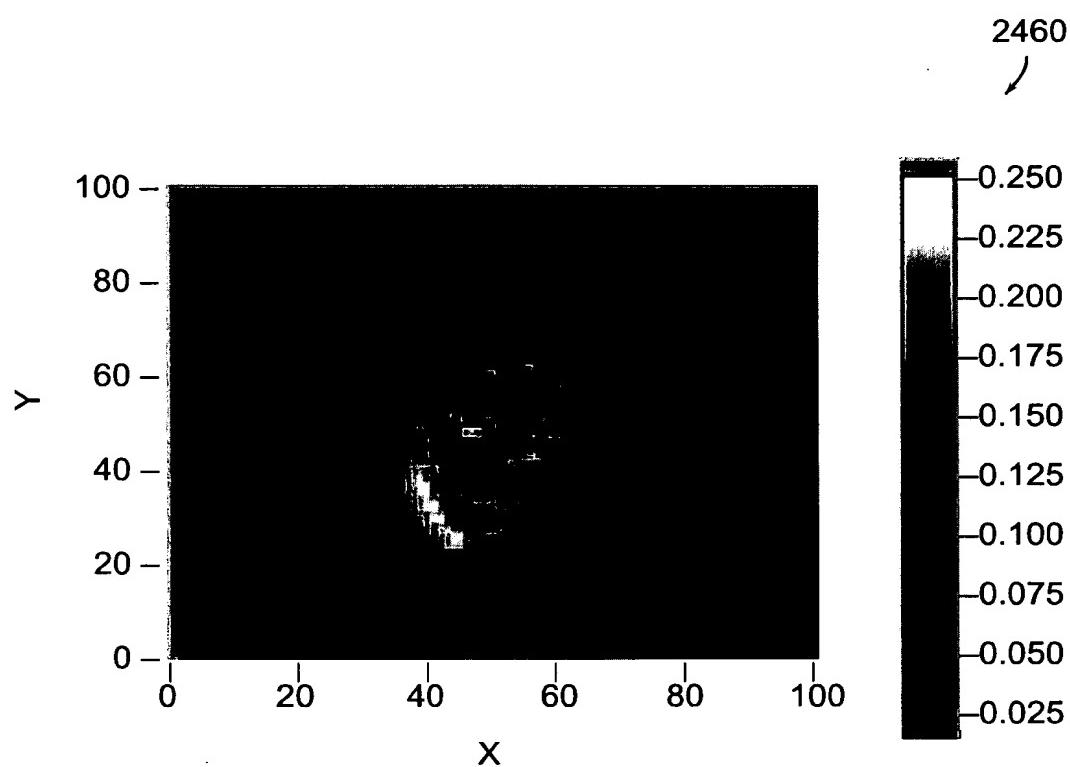


FIG. 46A

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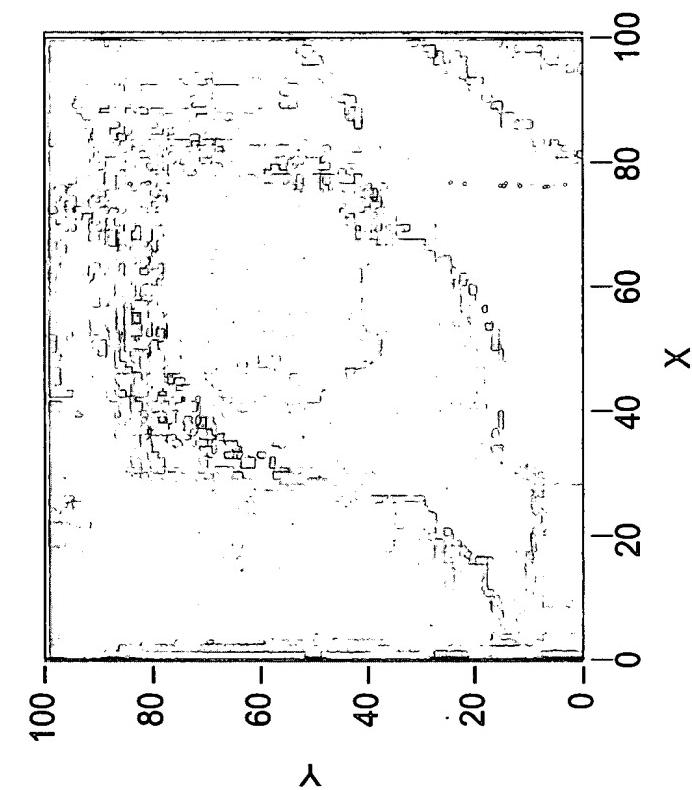
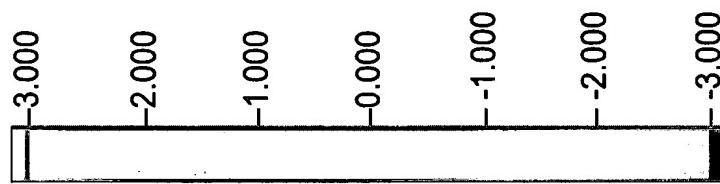


FIG. 46B

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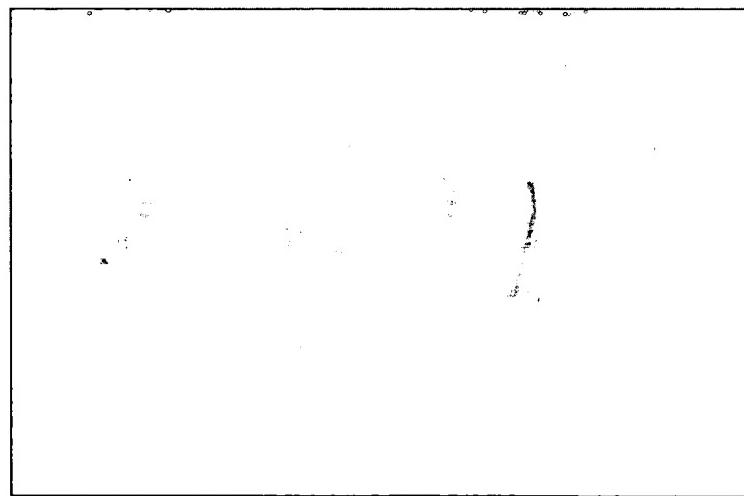


FIG. 46C

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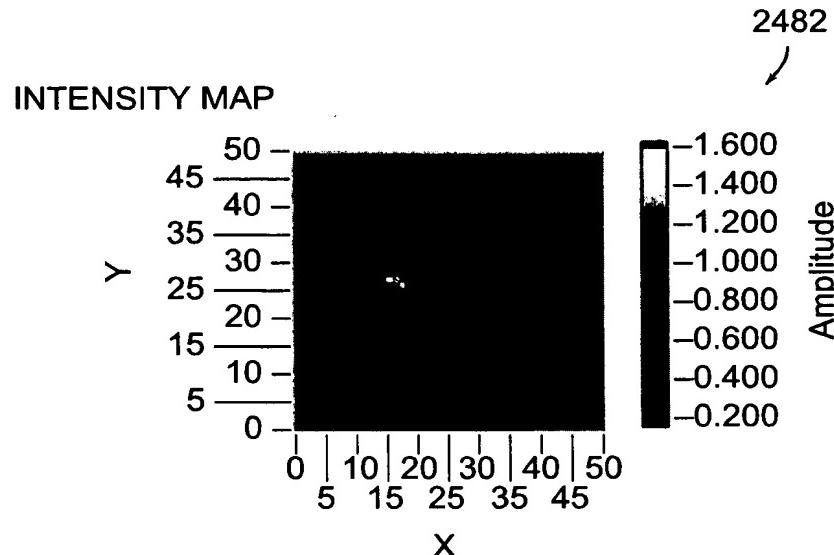


FIG. 46D

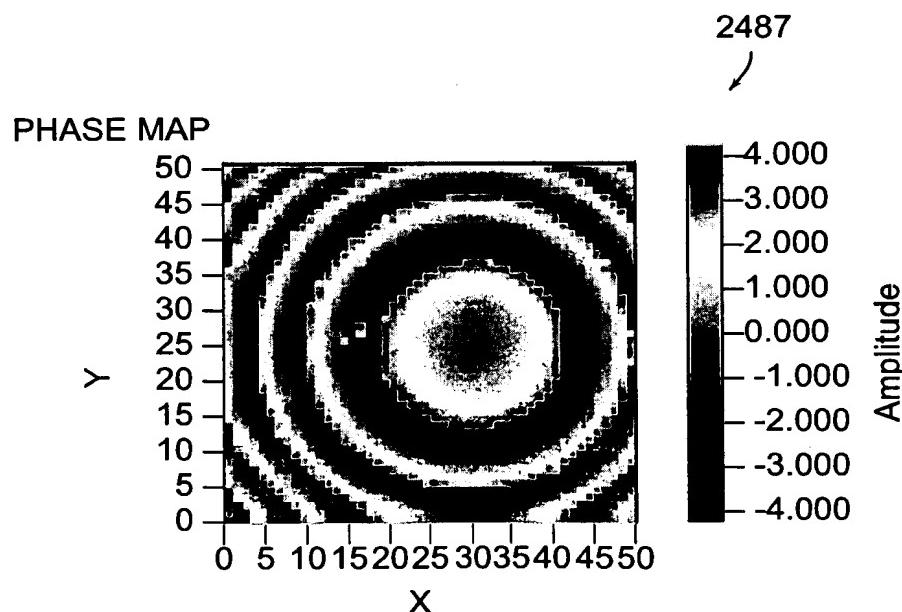


FIG. 46F

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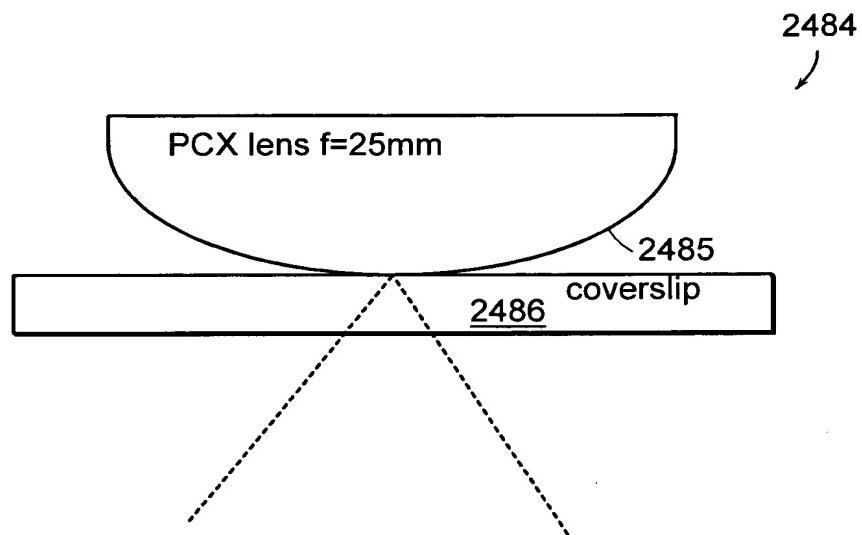


FIG. 46E

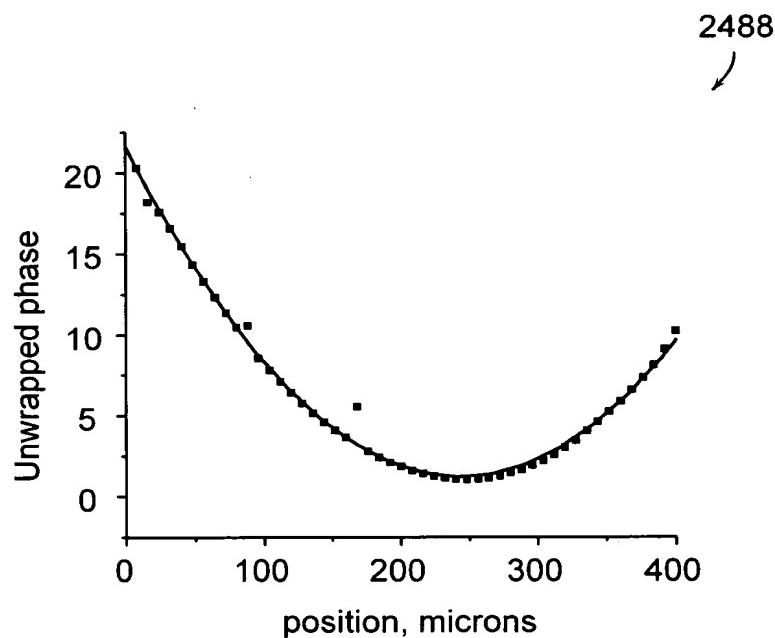


FIG. 46G

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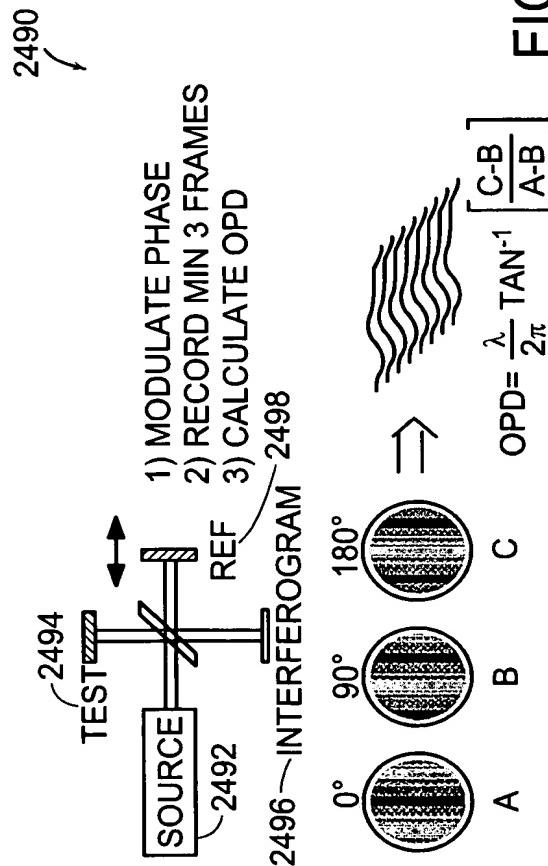
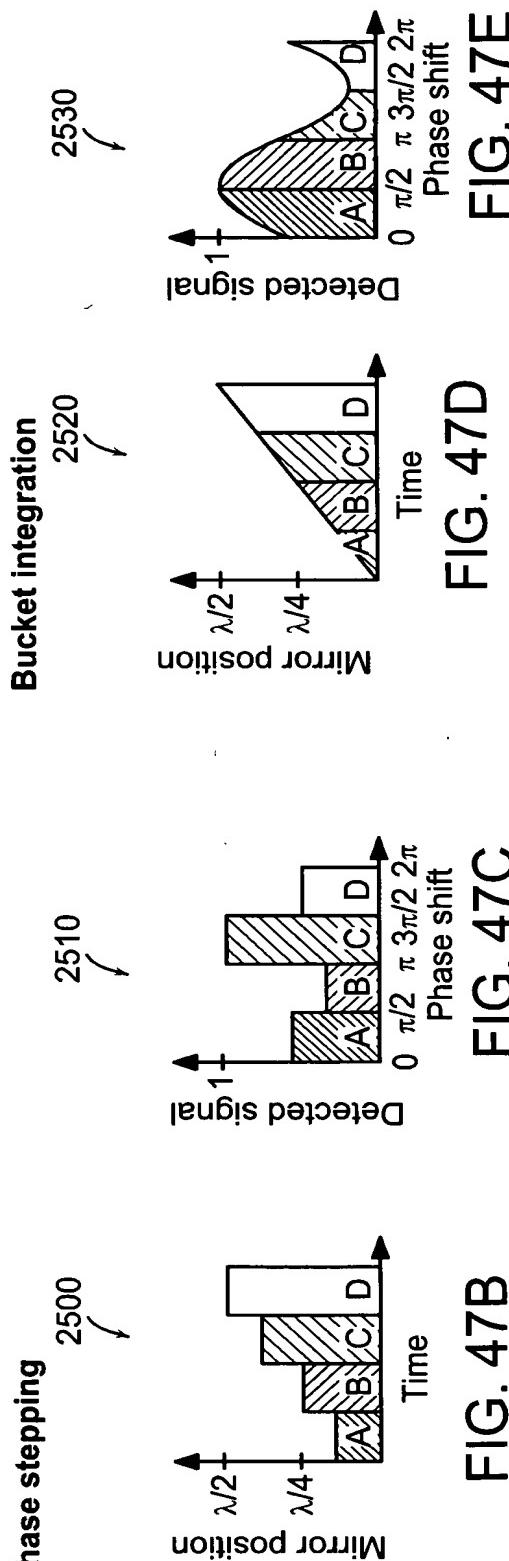
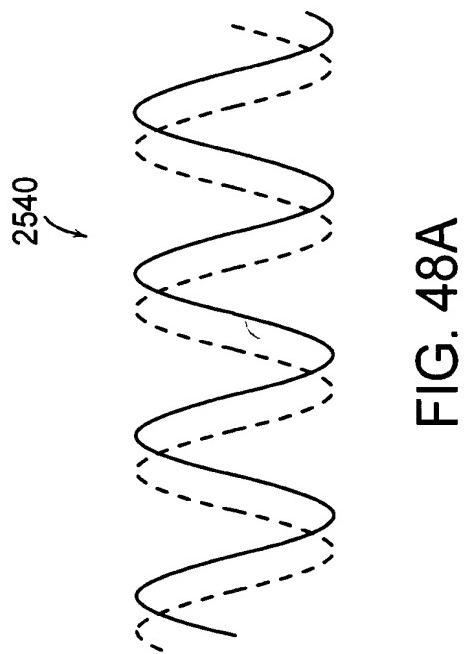
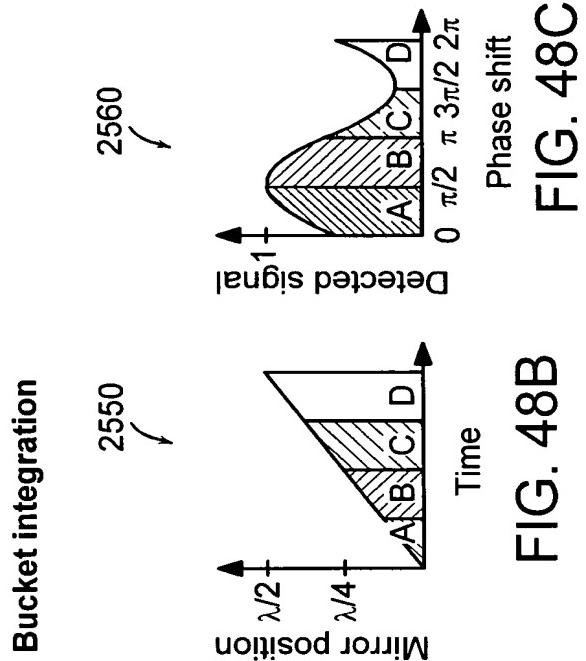


FIG. 47A



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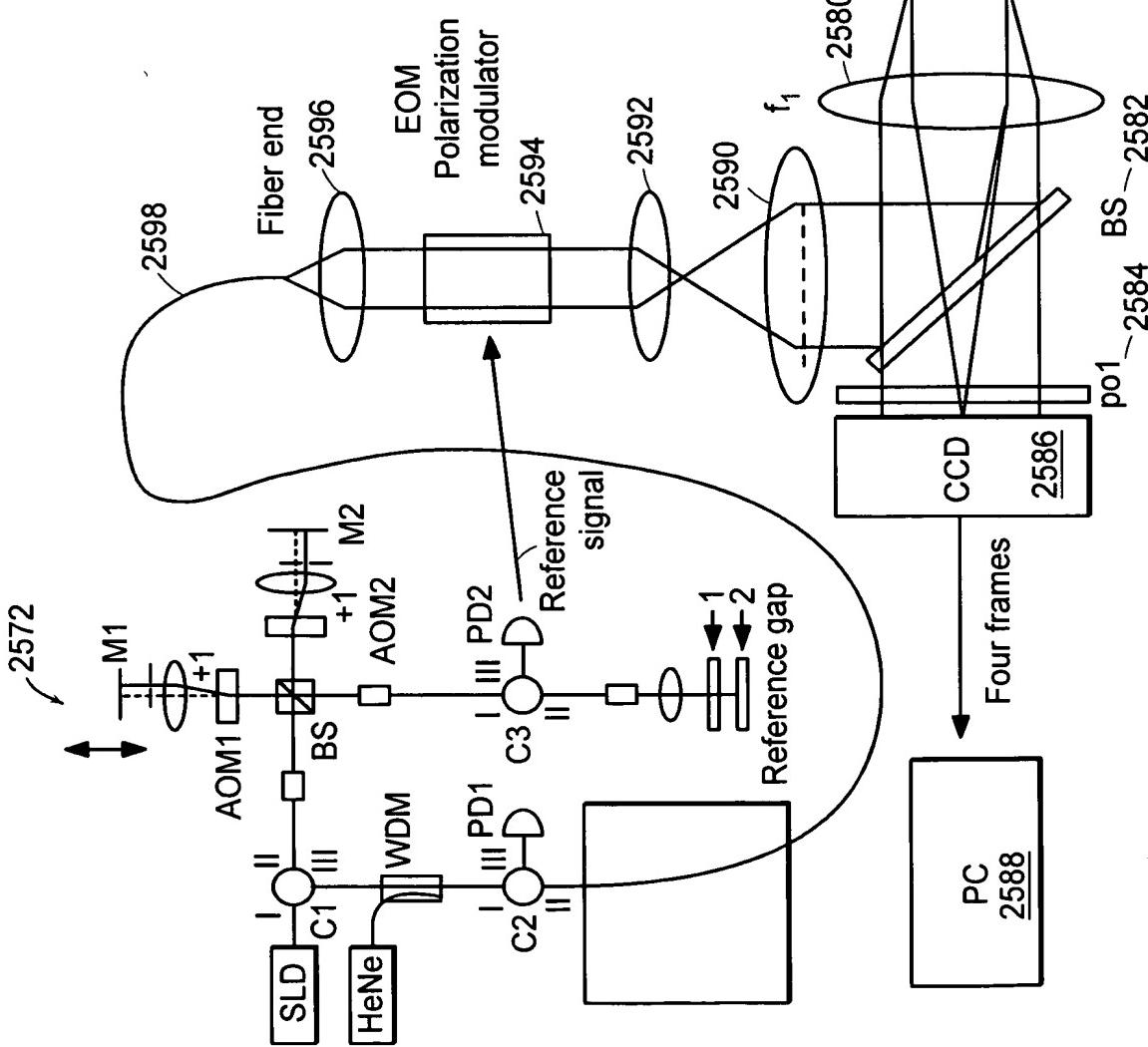
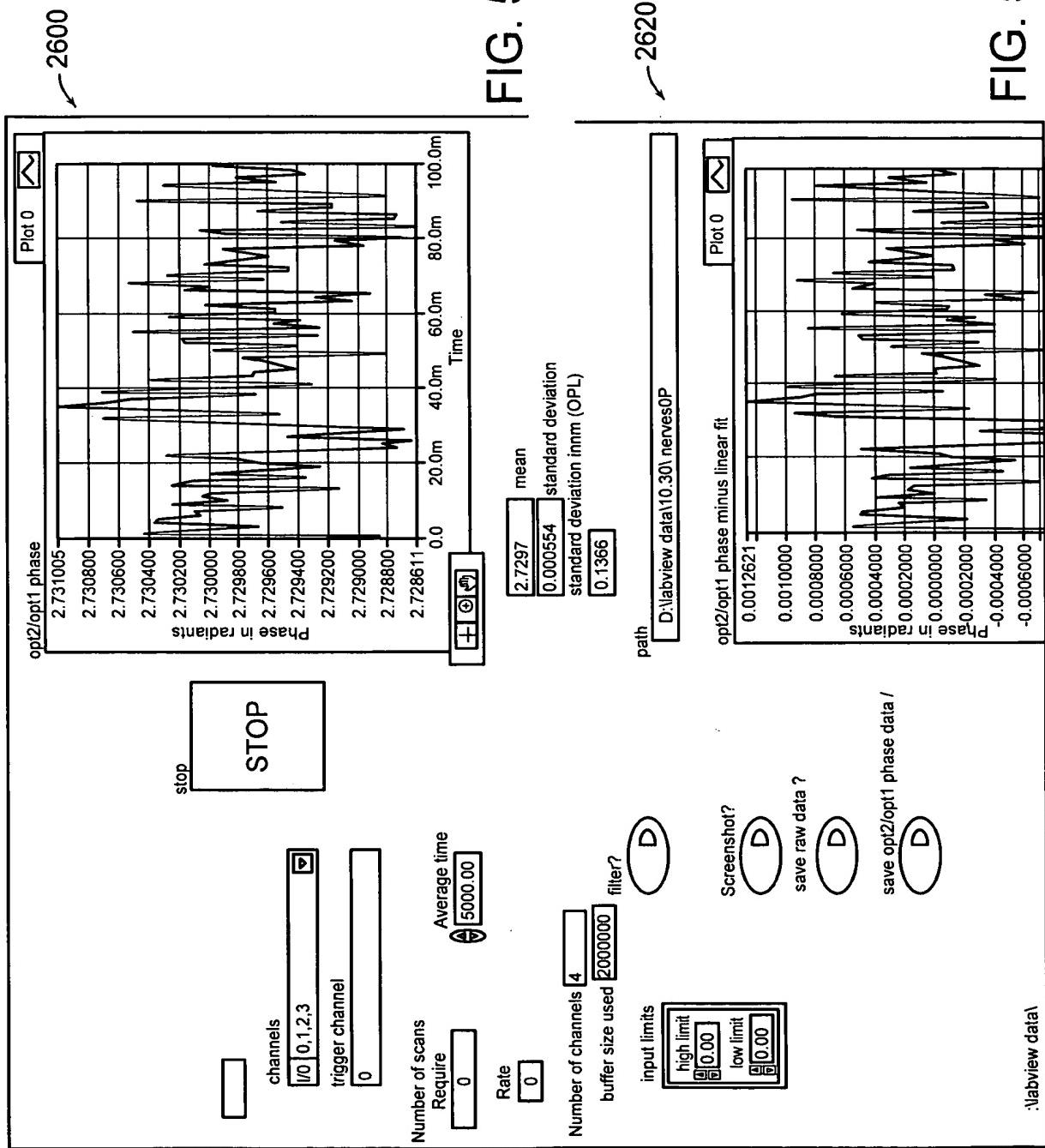


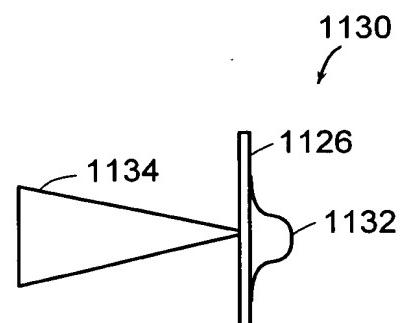
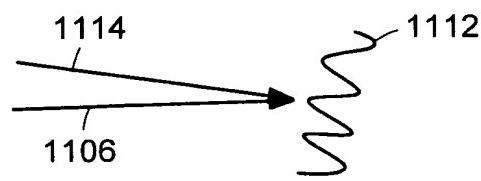
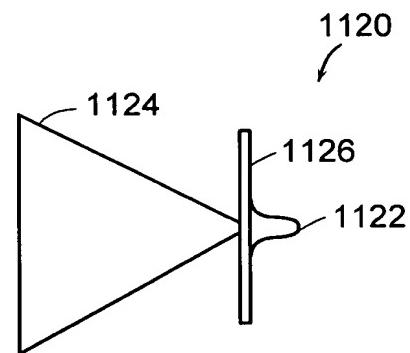
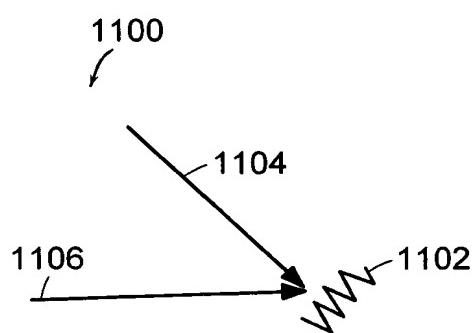
FIG. 49

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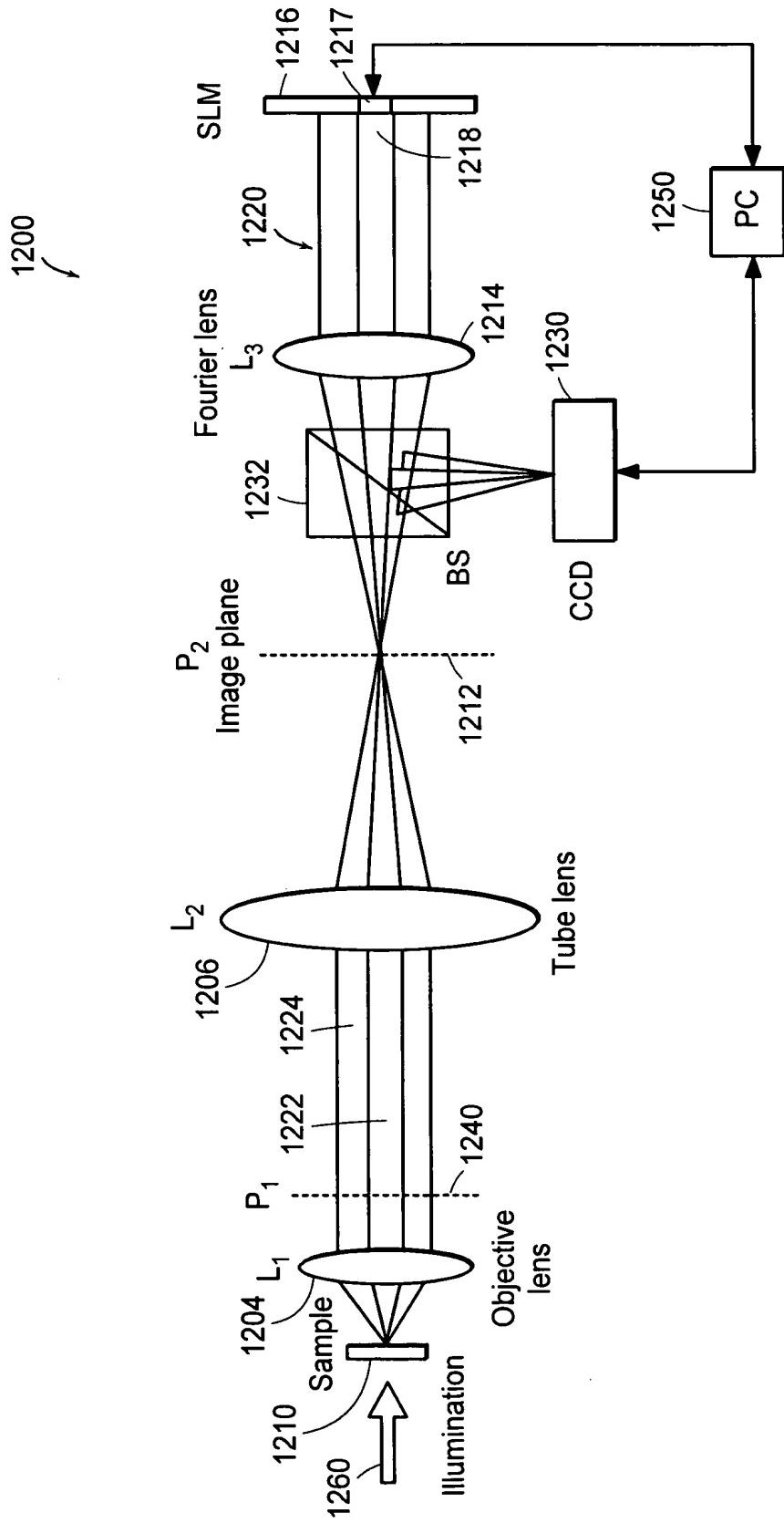


FIG. 52

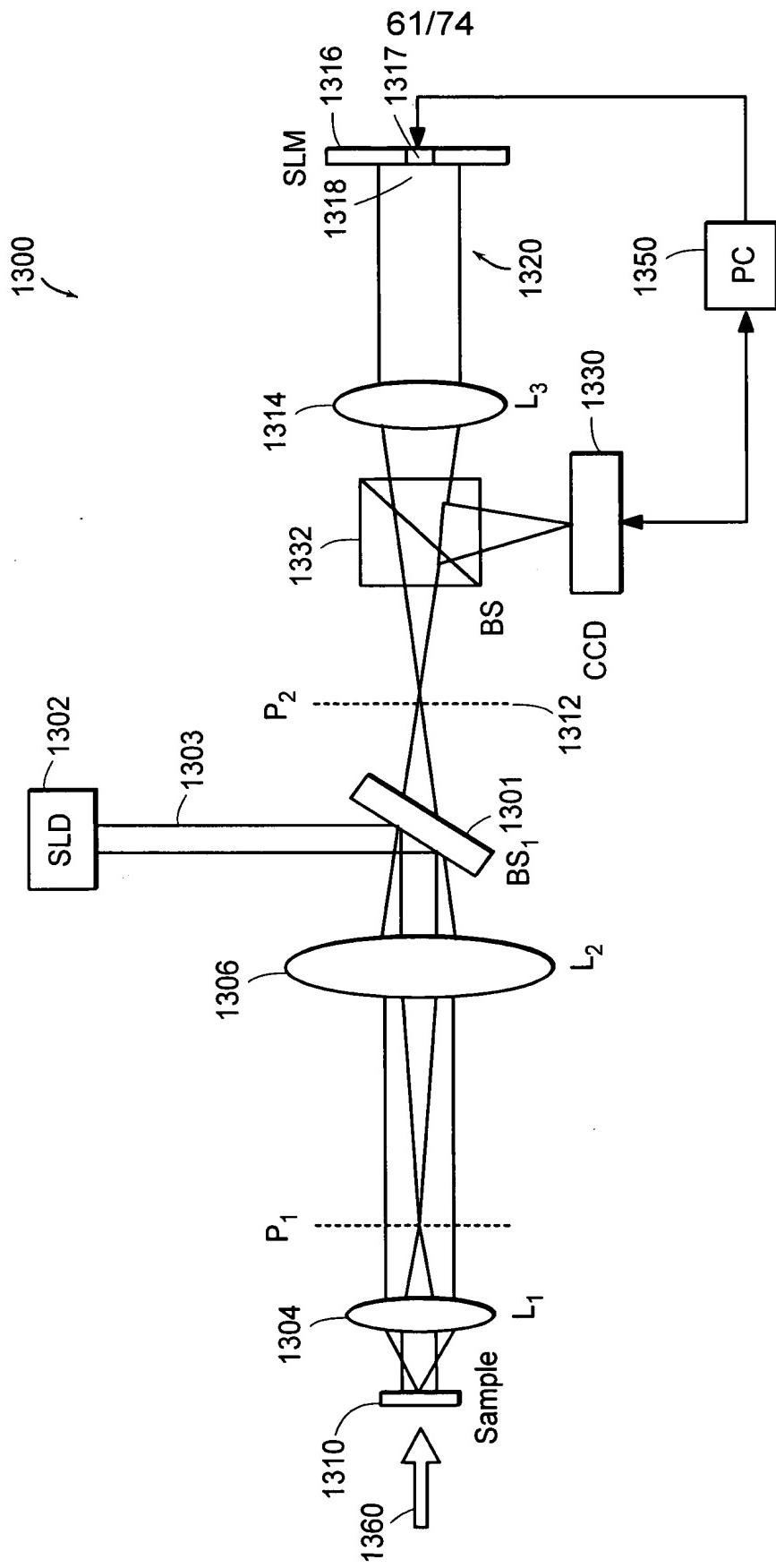


FIG. 53

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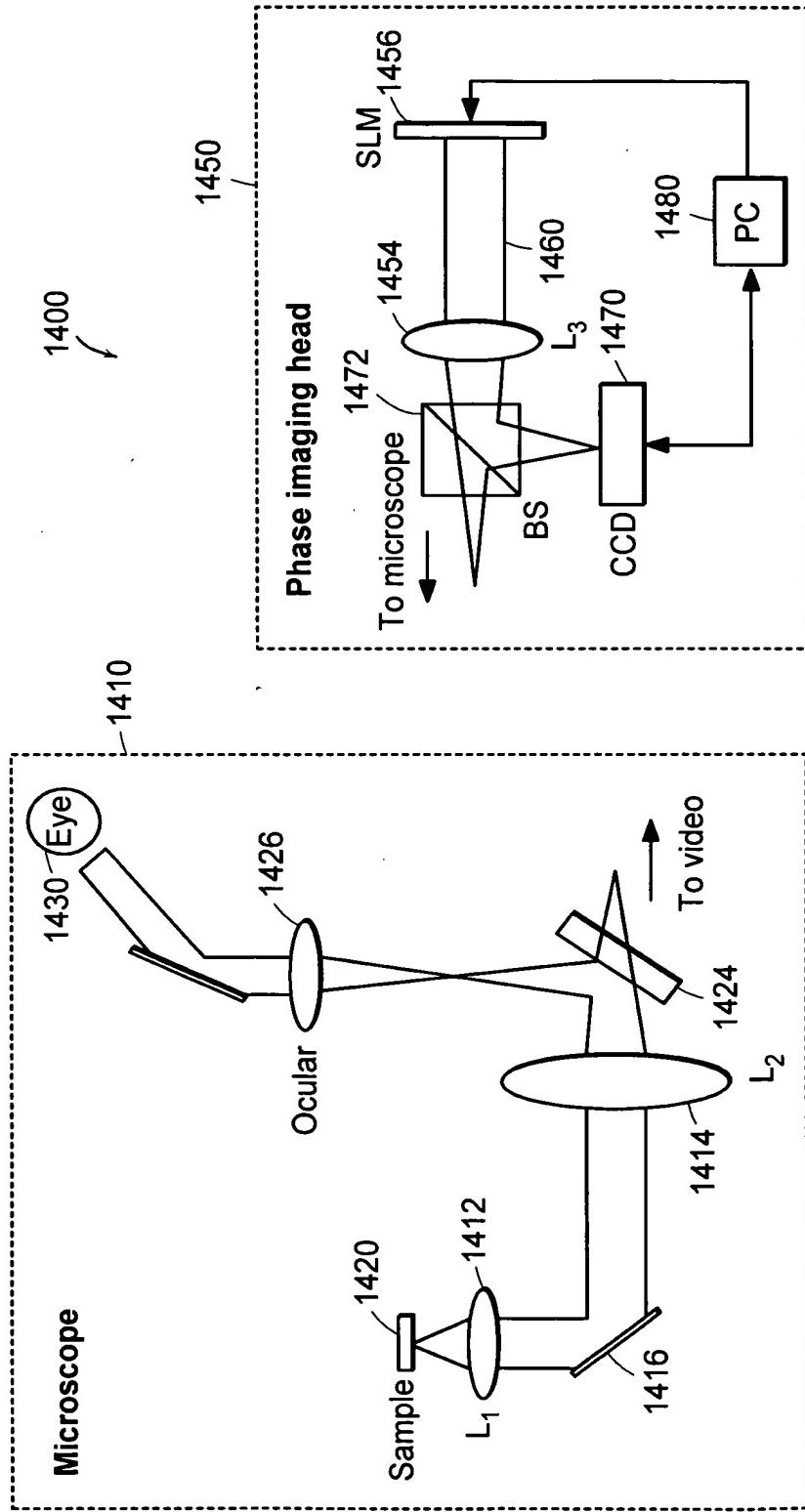


FIG. 54A

FIG. 54B

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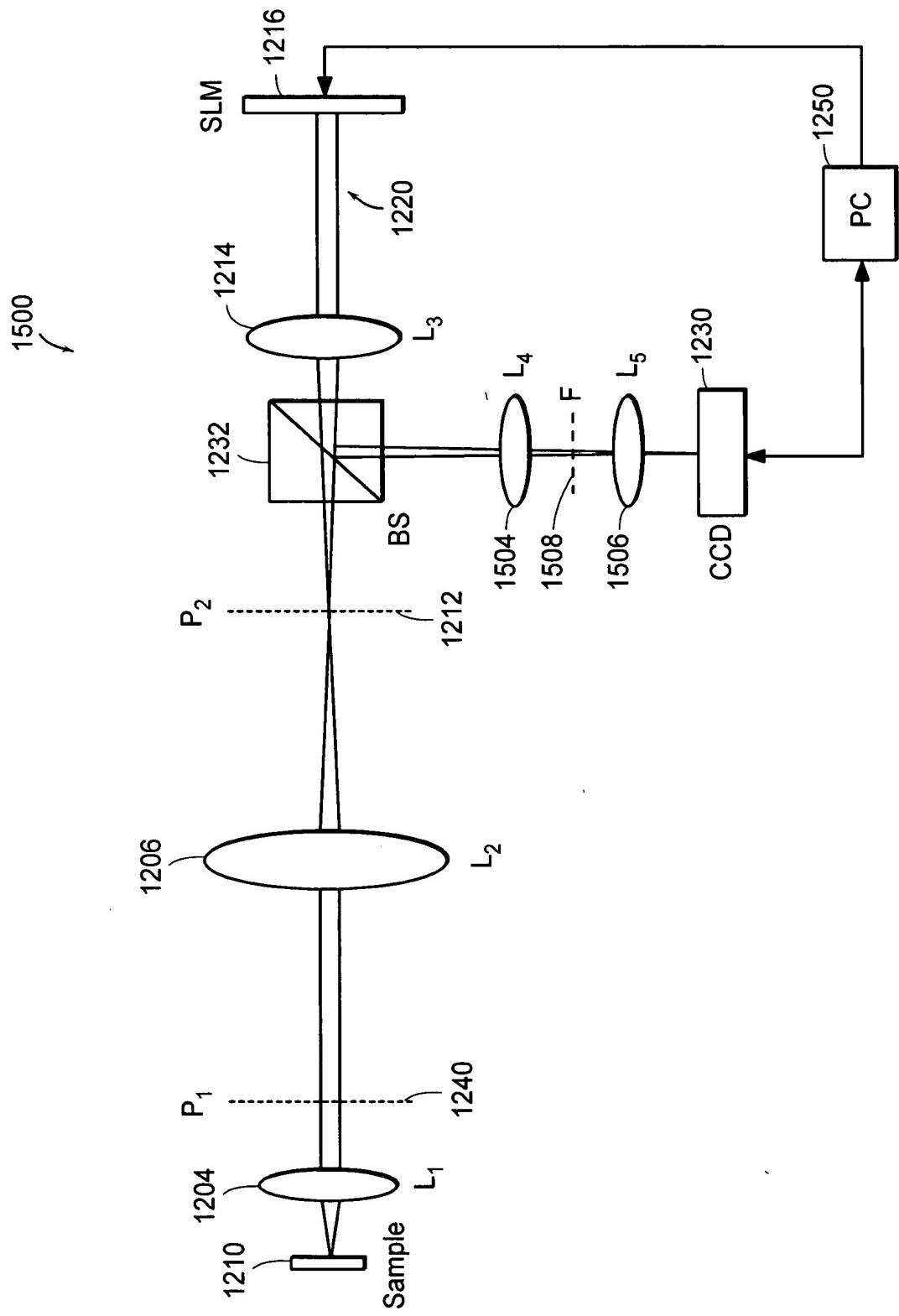


FIG. 55

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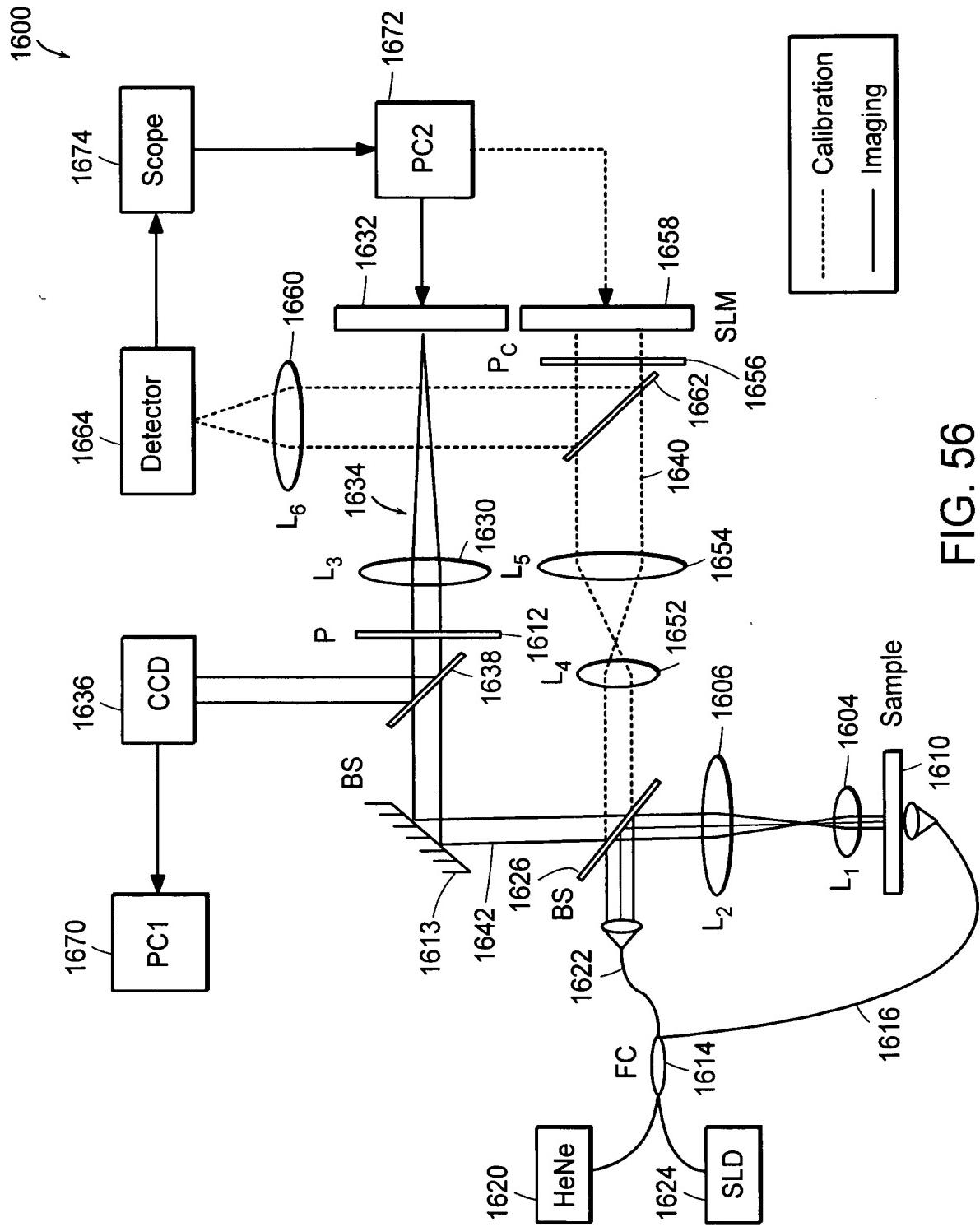


FIG. 56

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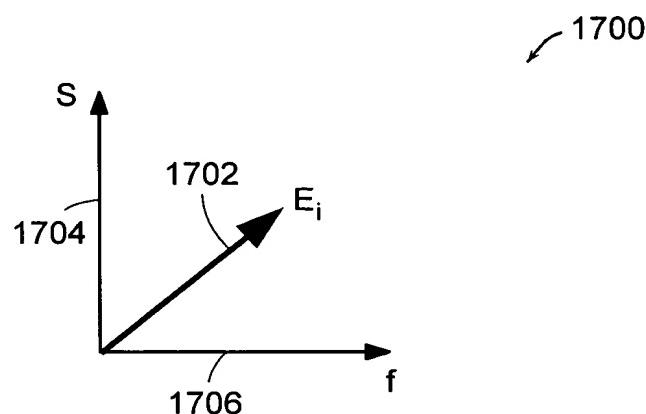


FIG. 57A

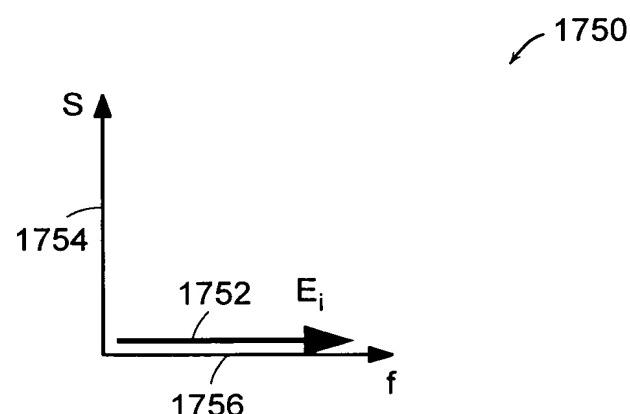
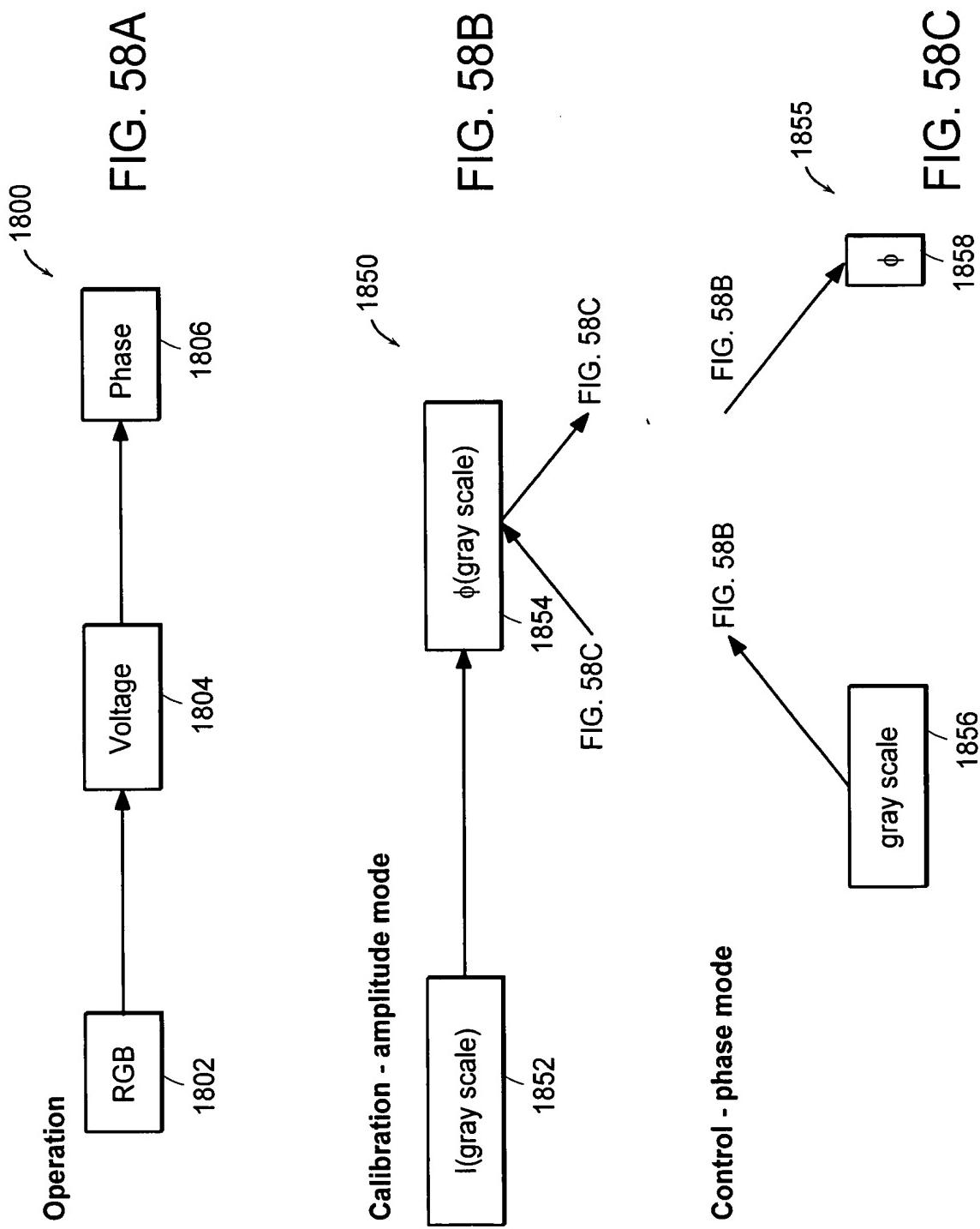


FIG. 57B

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Calibration Lookup Table

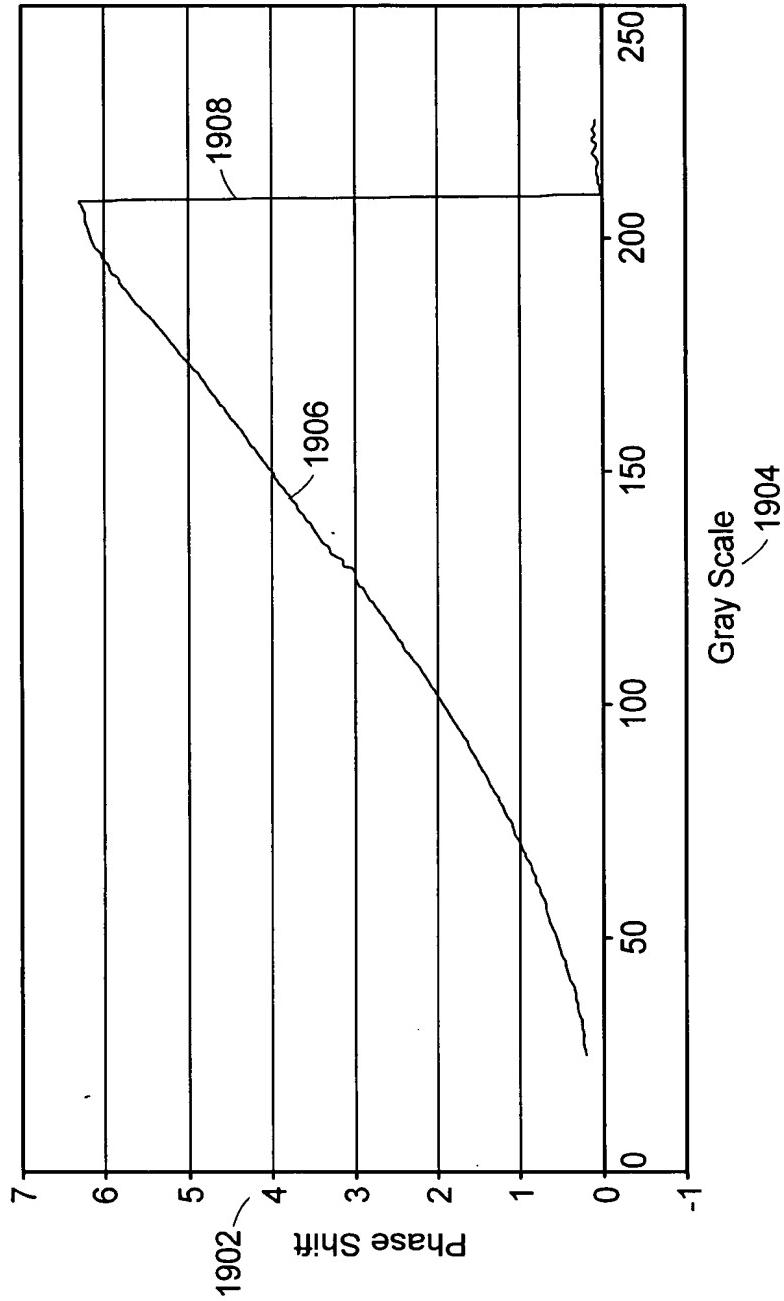


FIG. 59

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4-frame sequence
Magnification 13X

FIG. 60C

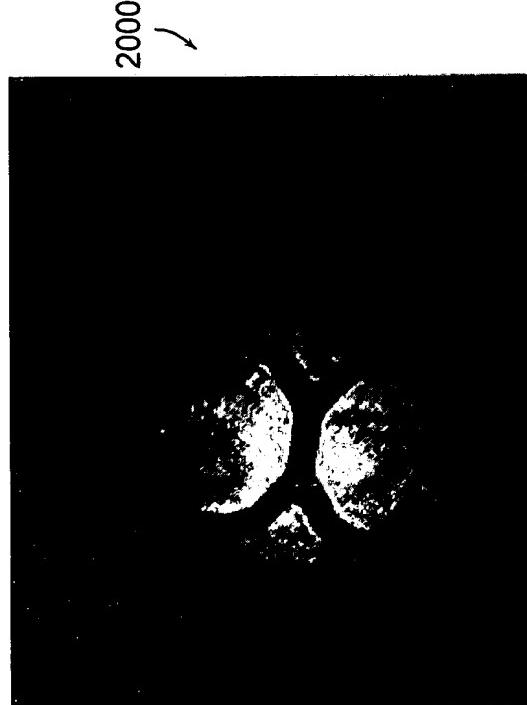


FIG. 60A

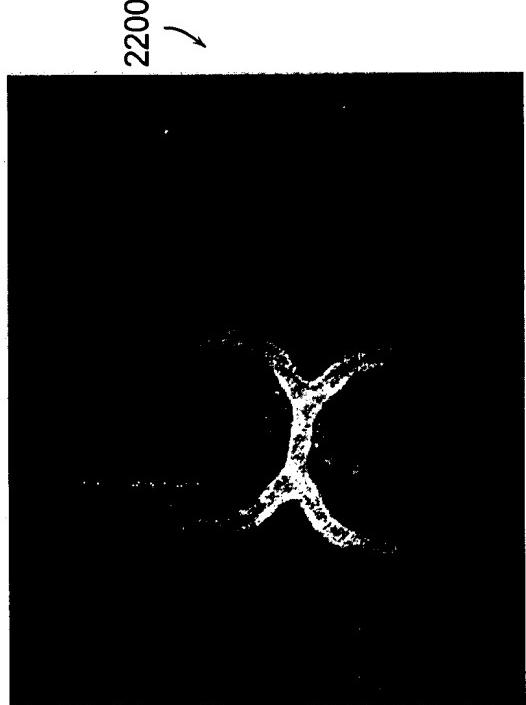
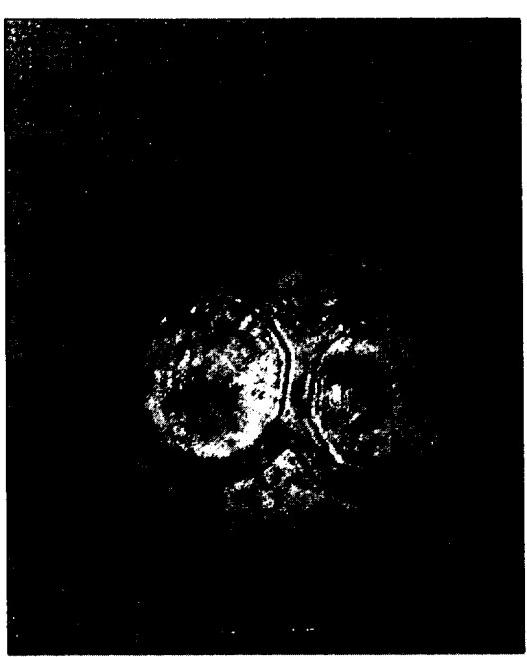


FIG. 60B

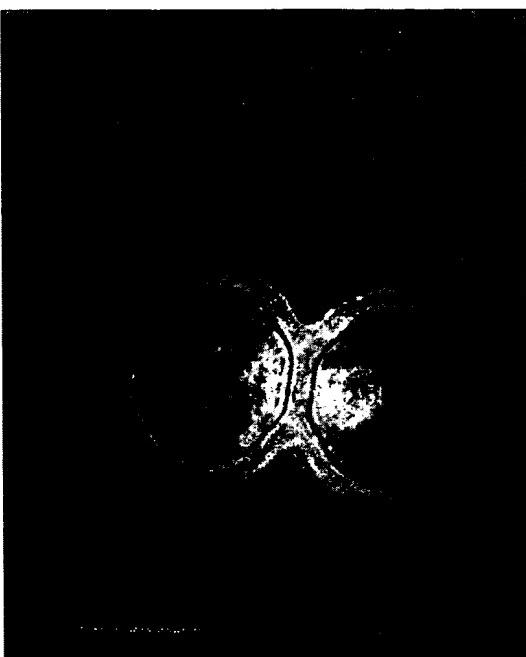


FIG. 60D

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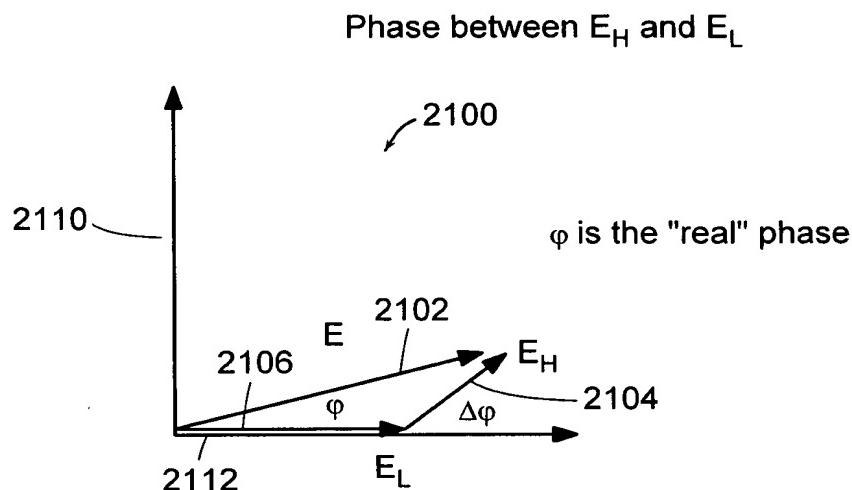


FIG. 61

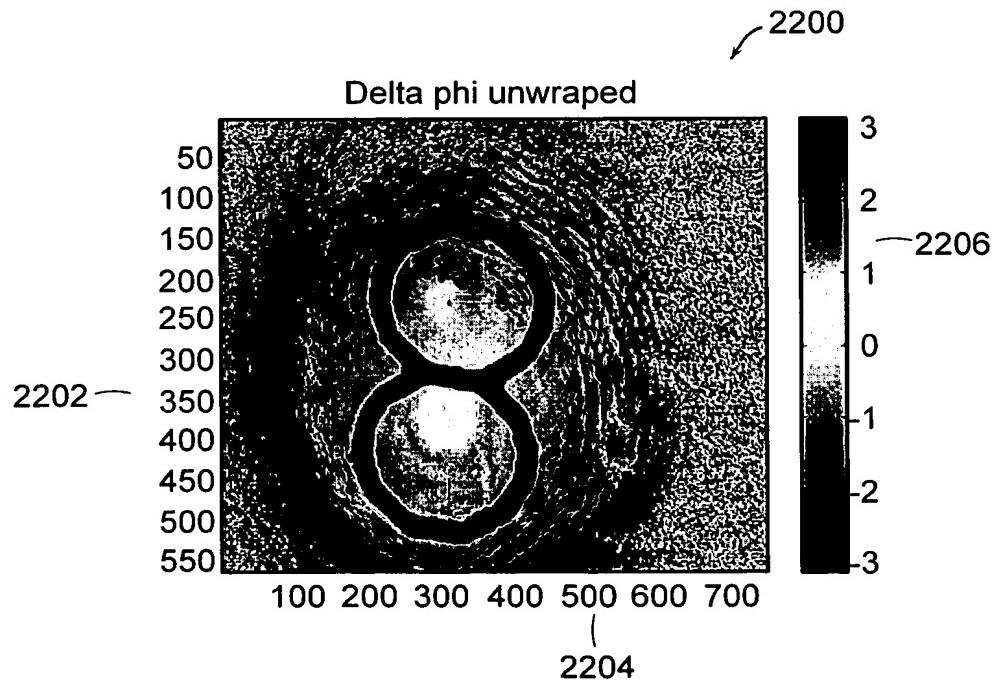


FIG. 62

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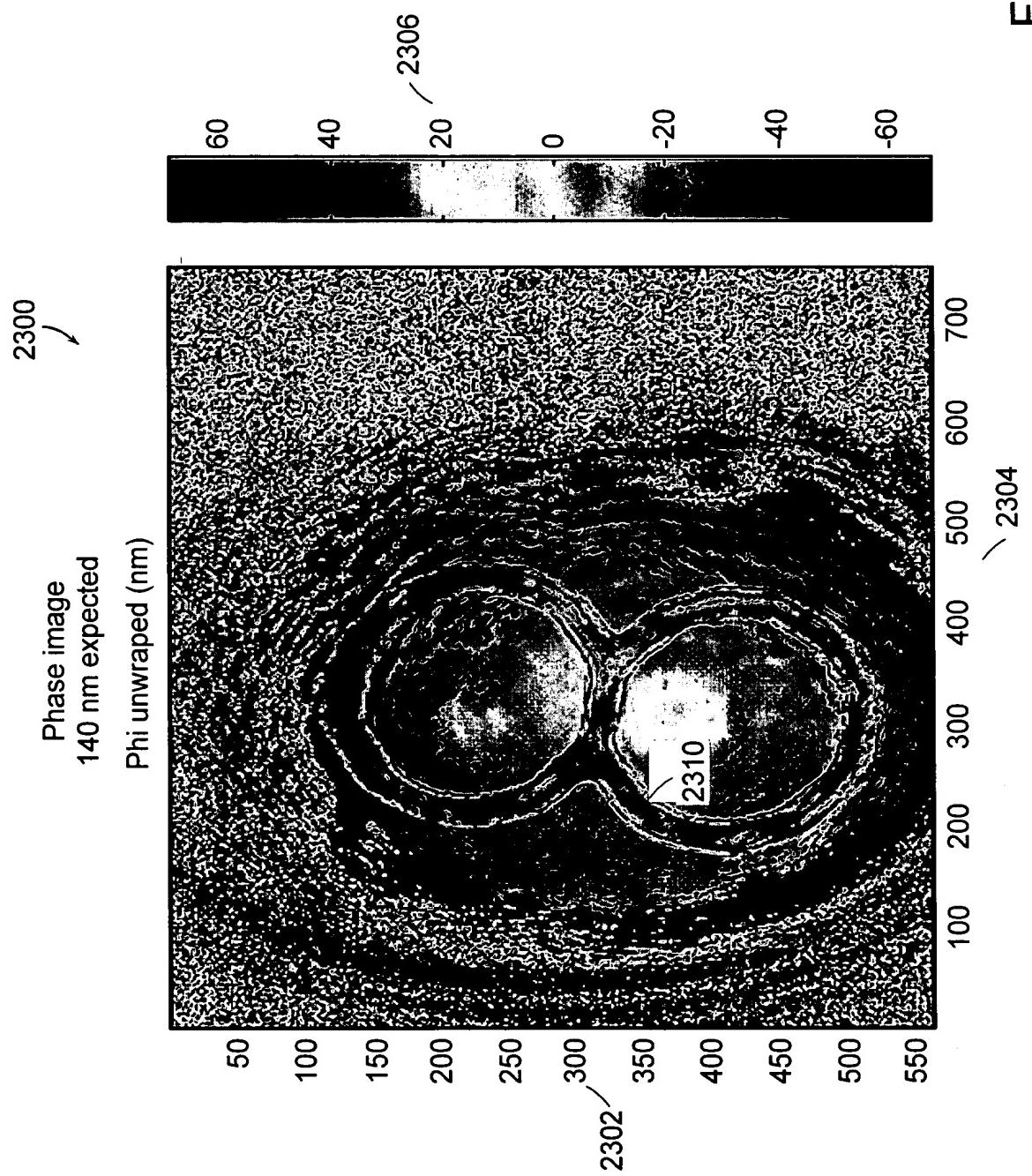
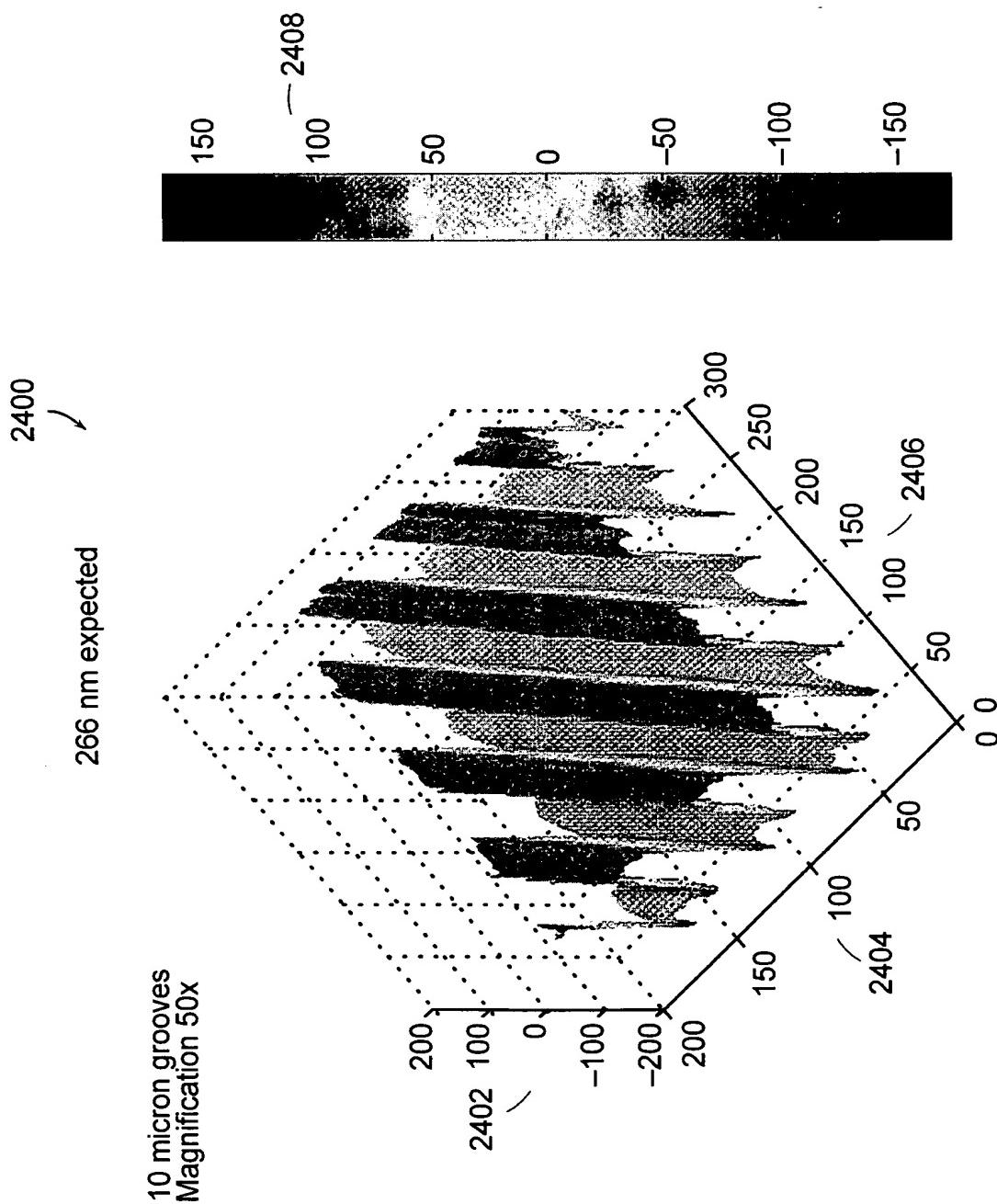


FIG. 63

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FIG. 64



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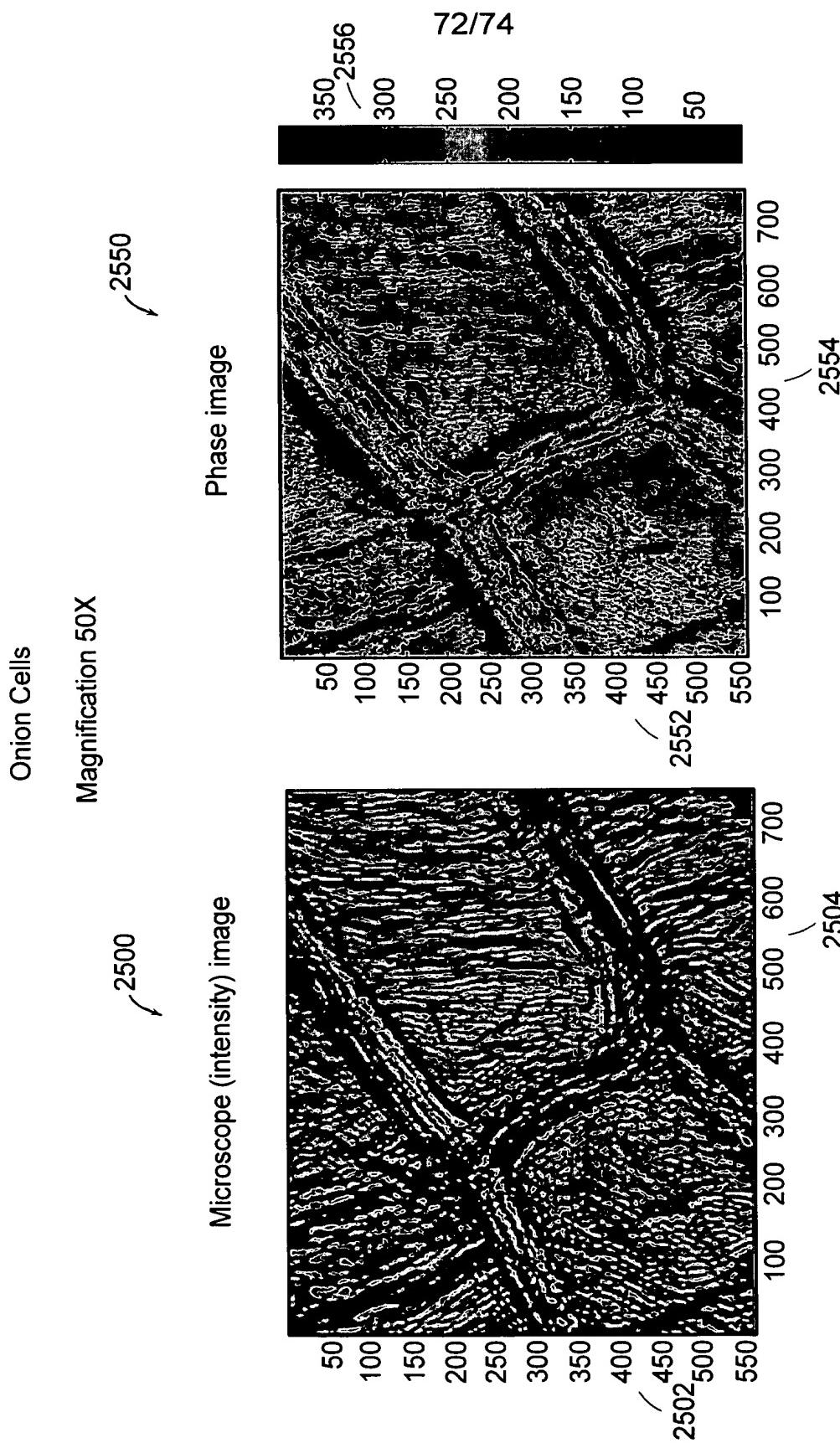


FIG. 65

FIG. 66

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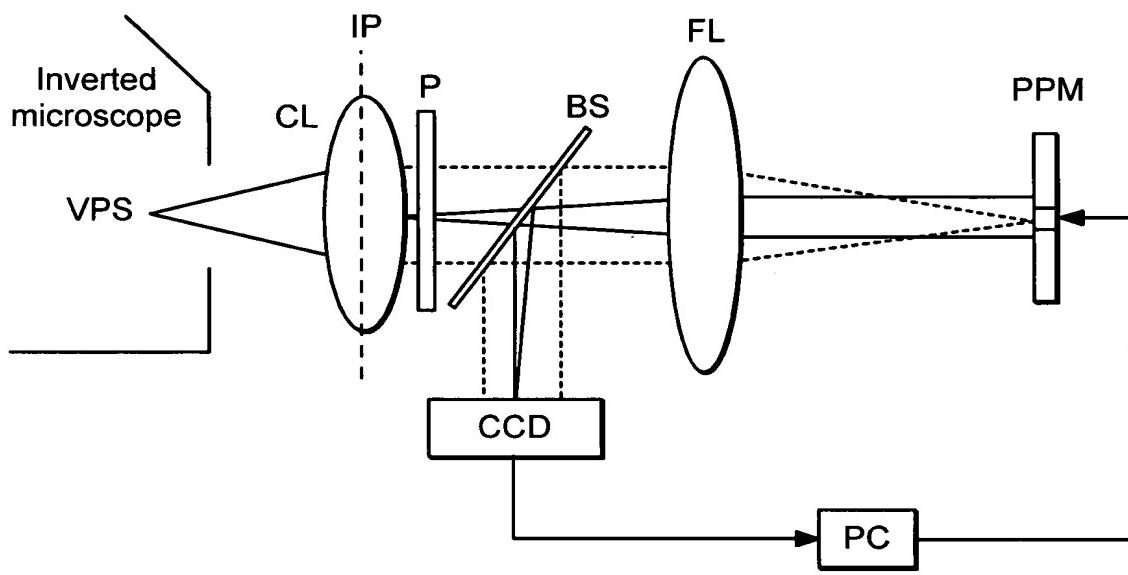


FIG. 67



FIG. 68A

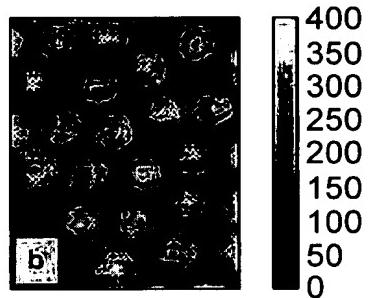


FIG. 68B

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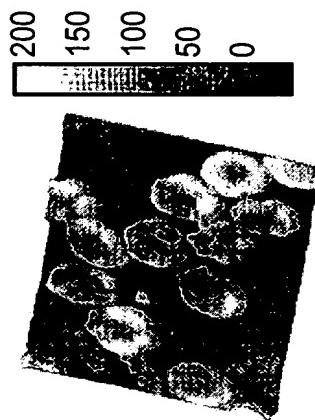


FIG. 69B

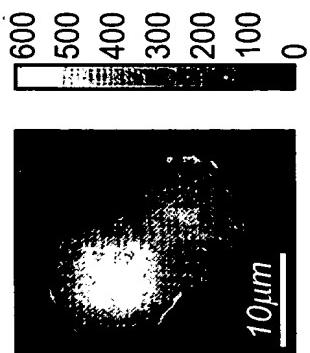
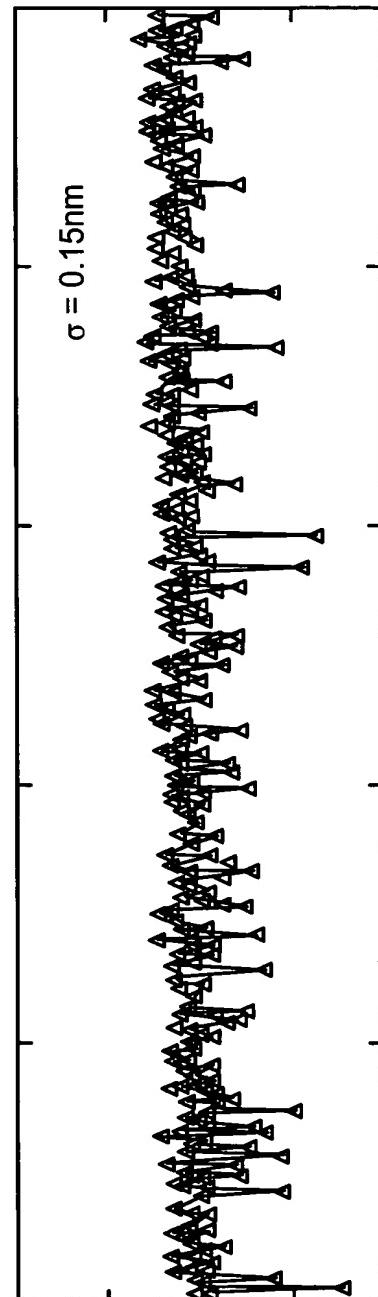


FIG. 69A



Time (min)
FIG. 69C

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